A Survey of the Coastal Fishes of the Southeastern Beaufort Sea

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ABSTRACT

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Fish samples were collected with gillnets, beach seines and hoopnets during surveys conducted in the spring, summer and fall open-water seasons in 1978, 1979 and 1980 along the southern Beaufort Sea coast between Richards Island to the west and Liverpool Bay to the east. Samples taken were analyzed to determine, on a species basis, seasonal distribution and relative abundance, age- and length-frequency distribution, sexual maturity, growth and feeding habits. In conjunction with fish sampling, depth, temperature, salinity, TDN, TDP, chlorophyll a, suspended particulate concentration and other physical and chemical environmental parameters were measured to delineate fish habitat features. Surface water quality within the estuary was variable depending upon distance from the Mackenzie River, time since spring freshet, wind velocity, local bathymetry and exposure of sites to wind and currents. The ranges for some water quality features for spring, summer and fall sampling periods respectively were as follows: Temperature (°C) 1.9-14.0, 7.3-13.9, 1.9-8.5; Salinity 0.02-30.74, 0.04-26.94, 0.06-30.53; TDN ($\mu g \cdot L^{-1}$) 130-460, 190-530, 150-340; TDP ($\mu g \cdot L^{-1}$) 3.1-41.7, 3.8-43.5, 4.1-11.0; chlorophyll a ($\mu g \cdot L^{-1}$) 0.4-4.1, 0.3-5.0, 0.5-3.3.

Surface water quality features for 23 lakes in the study area were also determined. Ranges over spring, summer and fall respectively are as follows: Temp (°C) 9.5-13.5, 8.8-15.9, 1.8-5.1; Conductivity ($\mu Siemens \cdot cm^{-1}$) 80-221, 96-219, 104-281; TDN ($\mu g \cdot L^{-1}$) 200-430, 190-710, 220-570; TDP ($\mu g \cdot L^{-1}$) 3.8-9.8, 3.4-42.2, 4.3-43.1; chlorophyll a ($\mu g \cdot L^{-1}$) 1.25-5.11, 0.2-5.7, 1.0-11.0.

Twenty-one species of fish were caught within the study area. Fourhorn sculpin and arctic flounder were the most abundant and widely distributed marine species, while Arctic and least cisco were the most abundant and widely distributed anadromous fish. Amphipoda, Mysidacea, Isopoda, Pelecypoda and fish were principal food items of coastal fish species.

Broad whitefish, least cisco and lake whitefish accounted for 84% of the total gillnet catch in study area lakes. Gastropoda, Amphipoda and Notostraca were the most important food items of these species. Inconnu, rainbow smelt and Arctic cisco, species common to the Mackenzie estuary, were absent from coastal freshwater drainages.

Most of the coregonid species present in the eastern Mackenzie estuary during the open water period were in a non-spawning condition. It is postulated that the spawners had migrated upstream to spawning sites within the Mackenzie River drainage prior to each year's spring sampling.

Two varieties of least cisco are described: an anadromous form, found principally in the estuary and a larger, faster-growing freshwater form, found exclusively in the small, freshwater lake and stream systems.

A number of streams of the study area were found to support large runs of coregonids (broad whitefish in particular) indicating that freshwater systems are of major importance to anadromous whitefish production in the region. Streams studied were too shallow to provide overwinter habitat for fish. Lake overwinter habitat appears to be less available on Tuktoyaktuk Peninsula than on Richards Island.

Many bays and lagoons of the study area were found to serve as rearing areas for juvenile (0+ and 1+ year old) coregonids and smelt which are presumed to be flushed downstream from Mackenzie River spawning locatons. Juvenile fourhorn sculpins, flounders and Pacific herring also utilize the nearshore embayments.

Key words: Mackenzie Delta; Tuktoyaktuk Peninsula; salinity; temperature; nutrients; estuaries; lakes; streams; sculpin; flounder; herring; cod; whitefish; cisco; inconnu; smelt; trout; pike; burbot; stickleback; grayling; distribution; abundance; feeding; life history.

RESUME

Lawrence, M.J. G. Lacho, and S. Davies. 1984. A survey of the coastal fishes of the Southeastern Beaufort Sea. Can. Tech. Rep. Fish. Aquat. Sci. 1220: x + 178 p.

Des échantillons de poisson furent capturés au filet maillant, à la senne manoeuvrés du rivage et au filet cylindrique pendant des études menées au printemps, à l'été, à l'automne, en eau libre, au cours des années 1978, 1979 et 1980 sur le littoral sud de la mer de Beaufort, dans une aire comprise entre l'Île Richards, à l'ouest, et la baie Liverpool, à l'est. L'analyse des échantillons a porté sur l'identification des espèces, leur distribution et abondance relative pour chaque saison étudiée, leur fréquence (par âge et par longueur), leur maturité génitale, leur croissance et leur nourriture. Lors de l'échantillonnage on a aussi noté les paramètres physiques et chimiques du milieu ainsi que les profondeur, température et salinité de l'eau, les TND, TPD, chlorophyll a et la concentration des particules en suspension. La qualité des eaux de surface dans l'estuaire variait selon le plus ou moins grand éloignement de la rivière Mackenzie, ainsi que d'après la longueur du temps écoulé après la crue printannière, la vitesse du vent, la bathymétrie et l'exposition plus ou moins grande aux vent et courant des endroits échantillonnés. Les fourchettes constatées pour certaines caractéristiques qualitatives de l'eau pour le printemps, l'été et l'automne respectivement sont les suivantes: température (°C): 1,9 à

14,0; 7,3 à 13,9; 1,9 à 8,5; salinité: 0,02 à 30,74; 0,04 à 26,94; 0,06 à 30,53; TND ($\mu g \cdot L^{-1}$): 130 à 460; 190 à 530; 150 à 340; TPD ($\mu g \cdot L^{-1}$): 3,1 à 41,7; 3,8 à 43,5; 4,1 à 11; chlorophyll *a* ($\mu g.L^{-1}$): 0,4 à 4,1; 0,3 à 5,0; 0,5 à 3,3.

Les caractéristiques qualitatives des eaux de surface pour les 23 lacs compris dans l'aire étudiée ont aussi été établies. Les fourchettes obtenues pour le printemps, l'été et l'automne respectivement sont comme suit: température (°C): 9,5 à 13,5; 8,8 à 15,9; 1,8 à 5,1; conductivité (μ Siemens$\cdot cm^{-1}$): 79,6 à 220,9; 96,3 à 219, 103,5 à 281; TND ($\mu g \cdot L^{-1}$): 200 à 430; 190 à 710; 220 à 570; TPD ($\mu g \cdot L^{-1}$): 3,8 à 9,8; 3,4 à 42,2; 4,3 à 43,1; chlorophyll *a* ($\mu g \cdot L^{-1}$): 1,25 à 5,11; 0,2 à 5,7; 1,0 à 11,0.

On a capturé vingt et une espèces différentes dans l'aire à l'étude. Le chabot de profondeur et la plie arctique étaient les plus abondantes et les plus répandues espèces marines, tandis que le cisco arctique et le cisco sardinelle étaient les espèces anadromes également les plus abondantes et les plus répandues. Les espèces côtières se nourrissent principalement d'amphipodes, de mysidacés, d'isopodes, de pélécypodes et de poissons.

Le corégone tschir, le cisco sardinelle et le grand corégone constituèrent 84% de toute la capture faite au filet maillant dans les lacs de la région étudiée. Ils se nourrissent en grande partie de gastéropodes, d'amphipodes et de notostracés. L'inconnu, l'éperlan arc-en-ciel et le cisco arctique - espèces que l'on rencontre dans l'estuaire du Mackenzie - étaient absents des bassins fluviaux d'eau douce côtiers.

La plupart des corégonidés présents dans les eaux libres de l'estuaire et du Mackenzie étaient des non-reproducteurs. On suppose que les reproducteurs avaient remonté la rivière vers les frayères dans le bassin fluvial du Mackenzie quelque temps avant l'échantillonnage du printemps chaque année.

Il y a deux variétés de cisco sardinelle: le cisco anadrome que l'on retrouve principalement dans l'estuaire, et un cisco d'eau douce de plus forte taille, à croissance plus rapide, et qu'on déniche exclusivement dans les petits systèmes de cours d'eau et de lacs d'eau douce.

On a découvert qu'un nombre de cours d'eau de l'aire étudiée abritaient de forts bancs de corégonidés (notamment le corégone tschir), ce qui indique que les systèmes d'eau douce sont très importants pour la production du corégone anadrome dans la région. Les cours d'eau étudiés étaient trop peu profonds pour servir d'habitat aux poissons durant l'hiver. Il semble qu'il soit plus difficile pour les poissons de passer l'hiver dans les lacs du péninsule Tuktoyaktuk que près de l'Île Richards.

On a constaté que de nombreuses baies et lagunes de l'aire étudiée servaient de lieu d'élevage pour les jeunes (0^+ à 1^+ an) corégonidés et éperlans, lesquels, suppose-t-on, ont été forcés à quitter leur frayère et à descendre le fleuve. Les jeunes chabots de profondeur, les plies et les ciscos du Pacifique se mettent aussi à l'abri des baies non loin du rivage.

Mots-clés: delta du Mackenzie; péninsule Tuktoyaktuk; salinité; température; substances nutritives; estuaires; lacs; cours d'eau; chabot de profondeur; plie; hareng; morue; corégone; cisco; inconnu; éperlan; truite; brochet; lotte de rivière; épinoche; ombre; distribution; abondance; nourriture; évolution biologique.

INTRODUCTION

The coastal region of the Mackenzie River estuary in the southeastern Beaufort Sea is unique in the Canadian Arctic. Not only does it provide the setting for a large human population which relies heavily upon the area's natural resources; the region has also supported active oil and gas exploration for the past two decades. The effects of the many growing and diverse anthropogenic activities on this large and dynamic estuarine ecosystem, are for the most part unknown. In the absence of an adequate understanding of the regional ecology, there exists significant potential for conflict in the search for a balance between renewable resource management and protection, and economic development and expansion. Recent forecasts of hydrocarbon production and transportation from the Beaufort Sea by the 1990's have added further to the need for a better information base for the region.

This report describes the results of the 1978-1980 fisheries surveys of the coastal freshwater and estuarine environments in the vicinity of the Mackenzie Delta during the open-water season. The surveys were one of a number of inter-related investigations carried out by the Department of Fisheries and Oceans concerning the life history, biology and ecology of fishes of the area (Bond 1982; Chang-Kue and Jessop 1983; Fallis, B.W., Department of Fisheries and Oceans, 501 University Cres., Winnipeg, personal communication; Lawrence et al., 1984). In the broadest terms, investigations were executed to address needs for information that would enable better protection and management of regional fish resources. The studies recognized the data gaps and recommendations made by Percy (1975) in his report for the Beaufort Sea Project.

Aspects of fish life history addressed in this report include species distribution and abundance, age- and length-class characteristics of local populations and the composition and variability of fish species' food habits. The surveys also described biophysical aspects of study locations and assessed some reproductive aspects of each species; such as age at sexual maturity, migration routes and times and possible spawning locations. Certain locations, because of their importance as spawning, feeding or overwintering habitat, have been identified for protection.

Other fisheries studies which have relevance to the objectives of this report, include the work of Kendel et al. (1975) along the Yukon coast as well as that of Galbraith and Fraser (1974) and Galbraith and Hunter (1975) in the southeastern Beaufort Sea.

STUDY AREA DESCRIPTION

The study area (Fig. 1) includes the lakes, streams, coastal embayments and nearshore water of the coastal region of the southeastern Beaufort Sea. The most westerly sample location was at the mouth of the Harry Channel (69°30'N, 134°50'W) in the Mackenzie Delta and the most easterly at an inlet on the Tuktoyaktuk Peninsula coast of Liverpool Bay (70°02'N, 129°30'W). Coastal sample sites were never more than 1 km from shore and seldom were more than 200 m offshore. Stream and lake sites sampled were all within 20 km of the coastline and were more often within a few kilometres. All of the lake and stream locations occur within the Pleistocene Coastland physiographic region described by MacKay (1963). This region consists mainly of Pleistocene fluvial and deltaic deposits and contains numerous lakes which cover 15% of the surface. Pingos are present throughout the area.

Coastal recession is rapid in the region and according to MacKay (1963) is aided by at least three factors: readily erodable granular material, numerous horizontal ice sheets, and violent westerly storms which cause water levels to rise and remove eroded and slumped debris. Coastal erosion in the region of numerous lakes has resulted in a highly indented coastline while active transport of sediments by longshore currents has created spits across the mouths of many bays. In areas east of Hutchison Bay, offshore bars run parallel to the coast at distances of several kilometers offshore (MacKay 1963). Lawrence et al. (1984) described the nature of the sediment being eroded and transported along the coast and made preliminary evaluations of the energy involved in working the beach environment.

During the summer months, the Mackenzie estuary is a particularly dynamic coastal environment. It is subject to wide fluctuations in temperature, salinity and turbidity due to variable mixing of warm, turbid Mackenzie River water with cold, saline seawater. The degree of mixing over the shallow expansive shelf is determined to a large extent by winds, by amount and proximity of ice cover and by the shearing effect between the eastwardly flowing estuarine water and the opposing Beaufort gyre current. Local coastline water conditions are dependent upon exposure to wind and currents. Mackenzie River lakes of the area are generally clear of ice by 30 June (Burns 1973).

The summer climate is characterized by mean maximum temperatures of 15.6°C over land and 12.8°C over water and mean minimum temperatures in July of 5°C (Fletcher and Young 1976). Continuous daylight occurs from late May or early June to late July. This results in the area receiving an amount of light energy during summer equivalent to that of temperate latitudes, despite the lower angle of incidence (Burns 1973). During much of the fall and spring, and all of the winter months, there is a net radiant energy loss from the region. Thus, dramatic seasonal differences in biomass production are to be expected.

METHODS AND MATERIALS

SAMPLING TIMES AND LOCATIONS

During the 1978 field season, three fish surveys were conducted along the Tuktoyaktuk

Peninsula to coincide with the spring, summer and fall seasons. Time periods were as follows: 26-29 June (Survey 1), 30 July to 5 August (Survey 2), and 1-4 September (Survey 3). A total of 44 bays were chosen between Canyanek Inlet (Loc. 1) and Johnson Bay (Loc. 53) along the Peninsula (Fig. 1). This provided a selection of sites which ranged from slightly brackish in the inner estuary to very brackish at the periphery of the estuary.

In 1979, seven sites from 1978 (Loc. 1, 4, 22A, 23, 31, 31A, 32) and the associated freshwater systems of five of them (Loc. 1, 4, 22A, 23, 31) were investigated (Fig. 1). Survey 1 was conducted during the periods 28-29 June and 15-20 July. This survey was divided into two time periods because of late ice-out conditions and unavailability of continuous helicopter support. Survey 2 followed from 1-8 August, and Survey 3 from 16-29 September.

Investigations during the three survey periods of 1980 (1-7 July, 1-6 August and 5-10 September) were conducted along coastal areas of Richards Island, west of Tuktoyaktuk (Fig. 1). Sixteen coastal sites and associated watersheds were examined and Canyanek Inlet (Loc. 1) was retained as a study site on Tuktoyaktuk Peninsula.

During each year, an attempt was made to survey each site three times. However, due to ice or high wind conditions which prevented deployment of gillnets from the helicopter, this was not always possible.

SAMPLING TECHNIQUES

A Bell Jet Ranger 206 helicopter equipped with floats was used to transport personnel and gear to sampling locations. All gillnetting and collection of water samples from coastal sites and lakes was performed from the helicopter. Water depth was measured with a hand-line and estimates of wind velocity were made based upon information provided by the Ministry of Transport at Tuktoyaktuk and from instrumentation in the helicopter.

Gillnetting

Swedish-made, 60 m (topline), green nylon multifilament gillnets were used. Each net consisted of six 10 m panels with square mesh sizes of 10 mm, 19 mm, 33 mm, 45 mm, 55 mm, and 60 mm. Net depth was 1.8 m.

At coastal locations, sets were limited to one gillnet for a period ranging from 1-6 hours. At freshwater drainages, at least two lakes were selected for gillnetting. One net was set in each lake with the fishing effort being maintained as close as possible, given the vagaries of weather and flight scheduling, to 24 hours.

Seining

Two seine hauls were performed at each coastal beach site using either a 10 or 18 m, 6.4 mm opening Raschel mesh seine.

Hoopnetting

Streams were monitored for movements of fish using 63.5 cm diameter hoopnets made from #35 delta nylon netting with a 3.2 mm oval Raschel mesh. Two hoopnets were used simultaneously to monitor both upstream and downstream movements over a 24 hour period. Streams were entirely blocked off by the hoopnet wings.

Hydrology

During each survey, velocity and discharge data were recorded at hoopnet sites using a Price No. 622 Type AA current meter and wading rod. A minimum of three velocity readings at 0.6 of total depth were made at each site. Sampling locations were chosen which had uniform flow. Boulders, rooted vegetation and severe meanders were avoided where possible during site selection.

Water quality measurements

1978: *In situ* measurements of temperature, conductivity and salinity were made at all coastal sites just below the surface using a YSI conductivity-temperature-salinity meter or a Beckman Model RS5-3 Portable Salinometer. Salinities from these field units are expressed in parts per thousand (ppt). In freshwater lakes only surface water temperature was measured.

A one-litre water sample was collected from each station and transported to the field laboratory for filtering of suspended solids. Suspended carbon, suspended nitrogen and total suspended solids concentrations were determined by the Analytical Chemistry Unit at the Freshwater Institute, Winnipeg. During the fall survey a 300 mL water sample was also collected for salinity determination on a Guildline Autosal Model 8400 salinometer at the Freshwater Institute. These salinity determinations have been converted to practical salinity values and are dimensionless (e.g. S=18.1) and are not expressed as parts per thousand (Lewis and Poisson 1982).

1979 and 1980: *In situ* temperature, salinity and conductivity measurements were made using a Beckman Model RS5-3 Portable Salinometer. A five-litre Van Dorn water sampler was used to collect seawater from just below the surface, and at or below the halocline if salinity readings indicated stratification of the water column. For each depth, a sample was dispensed from the Van Dorn sampler into a glass "B.O.D." bottle and fixed for oxygen determination. In addition, a two litre Nalgene bottle was filled and returned to the laboratory and a 300 mL glass bottle was filled for salinity determination on the Guildline Autosal Model 8400. The latter determinations were converted to practical salinity values.

Temperature profiles in freshwater lakes were recorded using a YSI temperature probe. Two-litre water samples were taken just below the surface using a Nalgene bottle. A one-litre water sample was collected at hoopnet sites

using a USDH 48 integrating sampler. Temperatures were recorded using a YSI temperature probe or a hand-held pocket thermometer.

Chemical analyses for the following parameters were were performed at the Fisheries and Oceans field laboratory in Tuktoyaktuk: pH, alkalinity, total dissolved phosphorus, conductivity, chlorophyll a, and partial processing of total dissolved nitrogen. Additional parameters analyzed in Winnipeg were as follows: total dissolved nitrogen, suspended nitrogen, suspended phosphorous, total suspended solids, salinity, and chlorophyll a. Chloride, sulfate, calcium, iron, magnesium, manganese, potassium, sodium and oxygen determinations were also done but have not been presented in this report.

FISH SAMPLE ANALYSIS

Catch records - seining

A representative sample from seine hauls, including unidentifiable fish, was preserved in 10% formalin for later identification in Winnipeg. The remaining undamaged fish were identified, counted, and released.

Catch records - gillnetting

Live and undamaged fish were released when possible. These fish were recorded and included in all catch-effort statistics. Dead sampling involved measuring fork length (mm), round weight (g), and examining gonads for degree of maturation. Sex and maturity wre recorded according to the following code:

Female	Male	
0	0	sex undistinguishable
1	6	immature
2	7	maturing
3	8	mature
4	9	ripe
5	10	spent

Age determination

Scales were removed from below the dorsal fin for age determination of the following species: Arctic grayling, broad whitefish, inconnu, least cisco, lake whitefish, Arctic cisco, and northern pike. Ages were determined by counting annuli under 50x or 90x magnification using a Leitz Trichinoskop IXQ Model 2.

Otoliths were collected from coregonids, smelts, fourhorn sculpin, lake trout, burbot, Pacific herring, saffron cod and starry and Arctic flounder. Ages were determined using otolith reading techniques as described by Bond (1982).

Stomach analysis

Stomachs containing food items were collected and fixed in 10% formalin for approximately one week, then transferred to 70% ethanol. Contents were identified to the Class or Order level and sorted in the Winnipeg laboratory using a variable magnification stereoscope. Sorted contents were oven dried at 90°C for 12 hours and then weighed to the nearest 0.01 g on a Mettler Model PL1200 electronic balance to determine the dry weight biomass of the contents of each stomach. The presence or absence of a food item in a stomach was used to determine the frequency of occurrence of that item in the diet of a fish species. Food items that accounted for at least 10% of the dry weight biomass of a sample, were listed as principal-prey of that species. Empty stomachs were recorded as such.

Age, length and weight analysis

Analysis of age, length, and weight data was performed on an IBM 370/168 computer using modified Statistical Analysis System (SAS) programs. Percent frequency histograms were done on a Hewlett-Packard 9831A calculator with plotter.

Catch per unit effort (CUE)

A catch-per-unit effort statistic (CUE) was calculated for each set and expressed as the number of each species captured per 60 m Swedish-made experimental net per one-hour period. The mean CUE statistic calculated for each species for each survey does not include locations where the species was not caught. A percent frequency-of-occurrence statistic to indicate patchiness of distribution was calculated using the equation:

$$\text{Freq } (\%) = \frac{n}{N} \times 100$$

where n = number of locations of capture and
N = number of locations fished.

RESULTS AND DISCUSSION

COASTAL HABITAT

The southern Beaufort Sea coastline from Harry Channel to Cape Dalhousie, a distance of 220 km, is characterized by numerous bays, lagoons, natural harbours and islands. These features account for approximately 1500 km of shoreline and provide a variety of fish habitat with a wide range of environmental and biologial features within the confines of the study area.

Water quality

Water quality in the estuary was variable, reflecting the degree of mixing of Mackenzie River and Beaufort Sea water. The mix of water and its suspended sediment load depended upon the rate of river discharge, the prevailing winds, water depth and the exposure of sample locations to wind induced currents and hydrodynamic circulation of the estuary.

Ranges of water quality features measured during the June/July, August and September sampling times respectively were as follows: temperature (°C) 1.9-14.0, 7.3-13.9, 2.1-8.5; salinity 0.02-30.74, 0.04-26.94, 0.06-30.5; pH

7.7-8.2, 7.9-8.1, 7.9-8.2; conductivity (μSiemens) 290-39 860, 270-36 600, 290-24 400; alkalinity ($mg \cdot L^{-1}$) 62.7-118.5, 72.7-123.1, 86.1-118.7; total suspended solids ($mg \cdot L^{-1}$) 2-123, 2-299, 4-217; total dissolved nitrogen ($\mu g \cdot L^{-1}$) 130-430, 190-530, 150-340; total dissolved phosphate ($\mu g \cdot L^{-1}$) 3.1-32, 4.1-43.5, 4.1-11.0; Chlorophyll a ($\mu g \cdot L^{-1}$) 0.4-4.1, 0.3-5.0, 0.5-3.3. Complete water quality data are tabulated in Tables 1-7.

The variability of selected parameters throughout the study area for each sampling time is depicted in Fig. 2-5.

Surface salinity in the study area ranged from undetectable to 30.74 (Fig. 3). Depth permitting, a halocline was observed at approximately 4 m below the surface.

During the spring survey of 1978, landfast ice restricted circulation of warmer Mackenzie River water into many of the locations sampled. As a result, colder water temperatures were observed in the nearshore in that year than in 1979 and 1980 (Fig. 2). The high range of temperatures in the June/July survey of 1979 was a result of the later and more protracted sampling period in the spring of that year (28 June - 19 July 1979).

Wind direction was found to have a pronounced effect on water circulation in the estuary and consequently on the salinities and temperatures observed. South or easterly winds directed Mackenzie River flow away from the Tuktoyaktuk Peninsula as well as from the west shore of Richards Island, causing an insurgence of colder, more saline offshore water to the nearshore in these locations. Wind vectors associated with each sampling period are presented in Tables 1 to 7. When winds had a westerly component, a corridor of low salinity, Mackenzie River water, was extended along the Tuktoyaktuk Peninsula coast.

Nutrients

The range and variability of total dissolved nitrogen (TDN) in the surface waters of the study area is shown in Fig. 6. Along the Richards Island coast in July 1980, TDN ranged from 130-430 $\mu g \cdot L^{-1}$ with lower values occurring in less saline waters and higher values at the more saline locations (Loc. 79, 77, 71). The nearshore values reflect the open water season TDN reported (Environment Canada 1981) for the East Channel of the Mackenzie River (170-600 $\mu g \cdot L^{-1}$). In August TDN was generally higher than in July and once again, more saline water was associated with higher TDN values. Higher productivity in the shallower, warmer, nearshore waters may account for the nitrogen depletion observed in the freshwater locations. Grainger (1974) on the other hand reported a progressive decrease in nitrate-nitrogen offshore from the Mackenzie Delta.

The TDN values observed along the Tuktoyaktuk Peninsula in 1979 were slightly higher than samples from Richards Island (1980). As with the Richards Island samples high TDN values were associated with more saline water.

The range and variability of total dissolved phosphate (TDP) concentrations in surface water is presented in Fig. 7. TDP ranged from 3.1-32.0 $\mu g \cdot L^{-1}$ in the spring of 1980 at Richards Island coastal sites. The majority of sites located in sheltered bays (Mason Bay, Mallik Bay and northeast Richards Island) had TDP values ranging from 3.1-8.6 $\mu g \cdot L^{-1}$ (Fig. 7). Locations along the west and north of Richards Island where greater mixing with Mackenzie River water occurs, had TDP levels in the 24.1-32.0 $\mu g \cdot L^{-1}$ range. TDP levels in mid-summer and fall 1980, ranged from 3.8-19.3 $\mu g \cdot L^{-1}$.

The high TDP concentrations reported along the Tuktoyaktuk Peninsula in the spring and summer of 1979 may reflect Mackenzie River inputs of phosphates. However analytical problems are suspected as similarly high and anomalous readings were obtained from the freshwater lakes where no Mackenzie River influence exists, during these same sampling periods.

Chlorophyll a

Chlorophyll a values ranged from 0.4-4.1, 0.3-5.0 and 0.5-3.3 ($\mu g \cdot L^{-1}$) in the spring, summer and fall respectively. The distribution of concentrations at locations sampled in 1979 and 1980 are shown in Fig. 8. Median and modal chlorophyll a intervals for spring, summer and fall were 1.51 and 2.00, 0.50 and 1.00 and 0.5 and 1.00 respectively, indicating a higher phytoplankton biomass soon after break up.

Fish species distribution

Twenty-one marine, anadromous and freshwater fish species were caught during the three survey years (Table 8). Numbers and species percent composition of gillnet catches at coastal locations are listed in Table 9. Marine species represented 52% of the fish caught along the Richards Island coast in 1980 with fourhorn sculpin, Myoxocephalus quadricornis (Linnaeus) and Arctic flounder, Liopsetta glacialis (Pallas) being the most abundant. Least cisco, Coregonus sardinella Valenciennes and Arctic cisco, Coregonus autumnalis (Pallas) were the most abundant anadromous fish.

Along the Tuktoyaktuk Peninsula, marine species represented 55% and 61% of the gillnet catch in 1978 and 1979 respectively. Fourhorn sculpin and Arctic flounder, as in 1980, were the most abundant marine species, while Arctic cisco and least cisco were the most abundant anadromers.

Less frequently caught species such as lake whitefish, Coregonus clupeaformis (Mitchill) were not captured at salinities exceeding 22; saffron cod, Eleginus gracilis (Tilesius) and Pacific herring, Clupea harengus pallasi Valenciennes were not caught at salinities less than 3. The euryhaline Arctic cisco and fourhorn sculpin were the most frequently and abundantly caught fish. The salinity ranges over which species were captured are presented in the life history descriptions which follow.

Cluster analysis of fish species distribution data was performed to display groupings of

locations which had a similar gillnet catch composition. Seasonal fish assemblage groups were mapped (Fig. 15-17). Table 10 gives the attributes of each assemblage grouping.

Feeding

The principal food items (10% of the total dry weight of the stomach contents) of each fish species from the Richards Island coast, the Kugmallit Bay coast and the Tuktoyaktuk Peninsula east of Tuft Point, were determined (Table 11). Principal food items varied depending upon area of capture, however Amphipoda, Mysidacea, Isopoda, Pelecypoda and fish were among the principal food items of all species except the Pacific herring.

LAKE HABITAT

Morphometric data for the twelve lakes which were sampled on the Tuktoyaktuk Peninsula and eleven on Richards Island are presented in Table 12. Water quality and other limnological data are presented in Tables 13-16.

The areas of lakes ranged from 87-1 854 ha on Tuktoyaktuk Peninsula and from 11-523 ha on Richards Island. Soundings done in connection with gillnetting showed that lakes on Tuktoyaktuk Peninsula were commonly more shallow than those on Richards Island.

Shoreline development (Welch 1948) of lakes ranged from 1.41-5.45 (Table 12).

Water quality

The variability of selected water quality parameters throughout the study area during each survey is shown in Fig. 9-14.

Conductivity of lakes on Richards Island ranged from 100-281 µSiemens with very little change observed from spring to fall. Tuktoyaktuk Peninsula lakes had a lower range of conductivity than did the Richards Island lakes (Fig. 9).

The pH of the majority of lakes on Richards Island was from 8.0-7.75 (Fig. 10). Tuktoyaktuk Peninsula lakes had a higher pH than did those on Richards Island.

No temperature data are available for lakes from the spring of 1979. In 1980 lakes on Richards Island warmed quickly after ice off with surface temperatures ranging from 9.5-13.5. The variablility in lake temperatures is shown in Fig. 11.

Nutrients

Total dissolved nitrogen (TDN) ranged from 200 $\mu g \cdot L^{-1}$-430 $\mu g \cdot L^{-1}$ in the spring survey of Richards Island lakes. The fall range of TDN values was in most cases higher than in spring, due to high nitrogen uptake during peak spring production period (Fig. 12).

Total dissolved phosphate (TDP) concentrations in Richards Island lakes ranged from 3.8-9.2 $\mu g \cdot L^{-1}$. Little change in TDP was observed over the open water period (Fig. 13). The high TDP values observed in the lakes on Tuktoyaktuk Peninsula in the summer and fall of 1979 may be the result of an analytical problem, as a similar difference between 1980 and 1979 coastal TDP values was also observed (Fig. 7).

Chlorophyll a

The variability in chlorophyll a concentration is shown in Fig. 14. Richards Island lakes ranged from 1.25-5.11 $\mu g \cdot L^{-1}$ in the spring period and by midsummer were generally less than 1.00 $\mu g \cdot L^{-1}$. Levels were slightly higher in the fall sampling period.

Chlorophyll a levels in Tuktoyaktuk Peninsula lakes were consistently higher (in both 1979 and 1980) than were those on Richards Island.

Fish species distribution

Three species of coregonids (broad whitefish, Coregonus nasus (Pallas), least cisco and lake whitefish) accounted for 84% of the fish gillnetted in the lakes of Richards Island and Tuktoyaktuk Peninsula (Table 17). Inconnu, Stenodus leucichthys (Guldenstadt), rainbow smelt, Osmerus mordax (Mitchill) and Arctic cisco were not caught in freshwater lakes. Some of the lakes studied were inhabited by anadromous migratory coregonids, some by non-migratory lake residents, and some by both. The migratory characteristics of each species are discussed under life histories.

Feeding

Gastropoda, Amphipoda and vegetative material were the most important food items of coregonids caught in all Richards Island lakes and those Tuktoyaktuk Peninsula lakes west of Tuktoyaktuk. Coregonids from eastern Tuktoyaktuk Peninsula fed mostly upon Notostraca, Cladocera and Amphipoda. Notostraca and Amphipoda also contributed the greatest biomass to burbot, Lota lota (Linnaeus) stomachs (Table 18).

STREAM HABITAT

Streams were generally small, ranging in width from 0.6-6.4 m. Those on Tuktoyaktuk Peninsula had discharges which ranged from 0.17-1.38 $m^3 \cdot sec^{-1}$ with maximum recorded velocities from 0-0.94 $m \cdot sec^{-1}$. Richards Island stream discharges ranged from 0.06-1.50 $m^3 \cdot sec^{-1}$ and maximum velocities from 0.19-0.97 $m \cdot sec^{-1}$ were recorded (Table 19).

Water quality of streams reflected the water quality of lakes above them. Total suspended solid (TSS) levels ranged from 1-7 $mg \cdot L^{-1}$ in streams on Tuktoyaktuk Peninsula, while Richards Island streams ranged from 1-3 $mg \cdot L^{-1}$ TSS.

No overwintering areas were found nor are any suspected in any of the streams studied.

FISH LIFE HISTORIES

Fourhorn sculpin, Myoxocephalus quadricornis (Linnaeus)

Seasonal geographic distribution, abundance and sexual maturity:

JUNE/JULY: Fourhorn sculpins accounted for 5.5, 2.8 and 22.9% of the total estuarine gillnet catch of fish in the 1978, 1979 and 1980 spring surveys respectively. Catch per unit effort (CUE) was low (0.15-0.95 fish per hour) at the 11 of 23 Tuktoyaktuk Peninsula locations where it was caught (Fig. 18, Table 20). The 1980 catches at Richards Island coastal locations ranged from 0.48-3.8 fish per hour.

Fourhorn sculpins were foundt at locations that ranged in salinity from 1-30 and temperatures from 1-9°C. The largest catches occurred where salinities exceeded 10 and temperatures were less than 6.5°C.

Few fourhorn sculpins were caught in seines during the 1978 and 1980 spring surveys (n=4 and 28 respectively). Based on their fork length range (37-87 mm) these are presumed to be one-year-old fish (Table 25). In 1979, numerous fourhorn sculpins (n=214) were seined at McKinley Bay (Loc. 31, 31A and 32) on 20 July. At this time, juveniles had a mean total length of 19.0 mm (range = 15-29 mm) and were, by inference from their length, in their natal year.

Female fourhorn sculpins dominated the spring gillnet sample, representing 100%, 80% and 74% respectively of the 1978, 1979 and 1980 sculpin catches (Table 26). No sexually mature sculpins were found in the 1979 and 1980 catches, whereas the majority of the 1978 spring catch were mature females which ranged in age from 5-12 years. The distribution of mature females was fairly widespread, being caught at seven coastal locations (Loc. 8 to 26, Fig. 1) on the same day.

AUGUST: Fourhorn sculpins accounted for 28.7, 10.3 and 17.0 % of the total catch of estuarine fish in the midsummer surveys of 1978, 1979 and 1980 respectively. They were caught at 73% of the locations fished (Fig. 18). Catch per unit effort was higher than during the spring survey (mean CUE = 2.35 fish per hour, range = 0.15-16.0 fish per hour). No other species was as widespread in its distribution, and only the Arctic flounder surpassed it in CUE (Table 20). Salinities (1980 data) where fourhorn sculpin were captured ranged from near fresh (0.04) to near oceanic (26.9). The maximum single catch occurred at Loc. 69 where the salinity and temperature were 26.9 and 7.3°C respectively.

Juvenile fourhorn sculpins were caught in greater numbers during the midsummer surveys than in the spring. Growth of the juveniles and migration towards the littoral areas account for the more abundant seine catches. The 1979 catch (n=92) were all from Loc. 31 (McKinley Bay) and were young-of-the-year with a mean length of 24.1 mm (range=14-39 mm). The 1980 young-of-the-year from Loc. 62 (n=48) had a mean total length of 27.5 mm (range=24-32 mm). Young-of-the-year were caught at Loc. 10 (mean length= 26.2 mm, range=20-28 mm, n=35) in 1978.

As with the spring catch, females dominated the midsummer catch, representing 70, 72 and 88% of the 1978, 1979 and 1980 sculpin catches respectively. None of the 1979 or 1980 fourhorn sculpins examined (n=18 and 8 respectively) were sexually mature whereas 24% of the 1978 midsummer catch (n=329) were sexually mature, ranging in age from 4-13 years.

SEPTEMBER: Fourhorn sculpins accounted for 32.8, 1.3 and 32.7% of the total estuarine catch for the 1978, 1979 and 1980 fall surveys respectively. The small catch of this species in the fall of 1979 (1.3% of total) was linked to the reduced coastal fishing effort as only Loc. 1 and 4 were fished. Sculpins were the most frequently caught fish during the fall, (occurring at 75% of the locations fished) and were the most abundant species (mean CUE=3.70 fish per hour) (Table 20, Fig. 18).

Salinity ranged from 3-31 where fourhorn sculpins were caught with the largest catches occurring at salinities from 3-27 and temperatures from 0.4-6.0°C.

Young-of-the-year fourhorn sculpins (mean length=32.7 mm, range=24-42 mm, n=10) were caught at three Tuktoyaktuk Peninsula locations in 1978 (Fig. 18). Four young-of-the-year (mean length=37 mm, range=35-40 mm) were caught at Loc. 82 along the Richards Island coast in 1980.

More than twice as many sexually mature fourhorn sculpins were present in the fall as in the summer samples. Females again outnumbered males by slightly more than 2:1 (Table 26).

Spawning and overwintering: Fourhorn sculpins have been caught in winter in Mallik and Mason Bays (Percy 1975) and at Shingle Point (Kendel et al. 1975). Salinities at these locations ranged from 4.9-9.6. Percy (1975) postulated that fourhorn sculpins spawn in late winter since both ripe and spent fish were taken through the ice in March. In Tuktoyaktuk Harbour, we caught one ripe and running female in January 1981 at a depth of 9.5 m, a salinity of 22.5 and temperature less than 0°C. The timing of spawning, whether early, mid or late winter, appears to vary somewhat with locale and is probably a result of variations in local water temperature and salinity regimes.

While fourhorn sculpin are known to overwinter in bays and inlets along the coast (Mason and Mallik Bays, and Tuktoyaktuk Harbour) the importance of offshore overwintering areas is not known.

Migrations: The pronounced increase in both abundance and frequency of occurrence of fourhorn sculpin adults between the time of our spring and summer surveys may have been the result of a return migration to the coastline from offshore areas. We suspect that fourhorn sculpins move to these offshore areas during the Mackenzie River spring freshet, to find preferable turbidity, salinity and temperature

regimes. An indication of the avoidance by fourhorns of the Mackenzie plume is provided by the scarcity of this species in all catches from the inner Kugmallit/Kittigazuit Bay areas.

Small numbers of fourhorn sculpins were observed to move as much as 1 km into coastal streams (Table 23). In these cases sculpins did not move beyond regions of tidal influence.

Length- and age-frequency distribution: The length and age statistics of gillnetted fourhorn sculpin from 1978, 1979 and 1980 are shown in Table 27. They ranged in age from 1-14 years, and in total length from 74-347 mm. Analysis of 1978 data demonstrated that females dominated the catches and attained a greater age than did male sculpins. (Mean age=6.7 for females, n=523; compared with 5.9 for males, n=213).

The age-frequency distributions for fourhorn sculpins are shown in Fig. 29.

Fourhorn sculpins in the 201-225 mm total length class were the dominant size in each of the 1978 surveys along the Tuktoyaktuk Peninsula. The dominant length interval of the Richards Island (1980) fourhorn sculpins was from 201-250 mm (Fig. 30).

Fourhorn sculpins caught in gill nets at Richards Island by Percy (1975) were of a similar length distribution (170-340 mm), with 70% in the 200-250 mm range. Those gillnetted in Nunaluk Lagoon, Kaktovik Lagoon and Simpson Lagoon in Alaska were smaller, with 190-230 mm, 190-210 mm and 150-170 mm modal length intervals respectively (Griffiths et al. 1977; Craig and Haldorson 1981).

Fourhorn sculpins from 51-150 mm fork length were seldom caught in either seines or gillnets. Seines consistently caught fourhorn sculpins less than 50 mm long, and gillnets effectively caught fish 151 mm and up. The absence of 51-150 mm long fourhorn sculpins has been reported by others who have employed these two gears (Percy 1975; Griffiths et al. 1977; Jones and Den Beste 1977; Griffiths et al. 1975). However Craig and Haldorson (1981) caught intermediate sized sculpins using a fyke net in Simpson Lagoon as did Hopky and Ratynski (1983) using small-mesh trap nets near shore and a bottom trawl at 5-15 m depths in Tuktoyaktuk Harbour.

Age-length relationship: The age-length relationships of fourhorn sculpin caught along the southeastern Beaufort coast in 1978, 1979 and 1980 are shown in Fig. 31 and Table 25. The Richards Island fourhorn sculpins were faster growing than fish sampled in 1978 along the Tuktoyaktuk Peninsula. This may indicate a real difference in growth, or may be due to an underestimation of ages for the 1980 sample possibly linked to the fact that these fish were taken in early summer prior to formation of that year's annulus.

Females grew significantly faster and bigger than males (Table 28 and Fig. 31) and lived longer (up to 14 years). Males did not surpass 11 years of age.

Andriyashev (1954) reported 0+ fourhorn sculpins to be from 20-24 mm long by August. Griffiths et al. (1977) reported a variety of growth rates, depending upon location. At Nunaluk Lagoon, Y.T., they grew from 16 mm at the end of July to 22.2 mm by 11 September. By comparison, those from Kaktovik Lagoon, Alaska, grew from 15-31 mm between early July and September.

The growth of young-of-the-year (0+) fourhorn sculpins from the southern Beaufort Sea coast, fell within the range of growth rates reported from the Alaskan, Yukon and Siberian coasts (Griffiths et al. 1977; Andriyashev 1954). In 1978, 0+ sculpins from the Tuktoyaktuk Peninsula grew from a mean length of 26 mm in August to 33 mm by the first week of September. The mid July 1979 0+ sculpins were 19 mm long, and by early August had increased to 24 mm total length. In 1980, early-August 0+ fourhorns had a mean length of 27.5 mm and by the second week in September had grown to a mean length of 38.6 mm.

Food habits: Stomach contents of fourhorn sculpin from the coastal bays of Richards Island, western Tuktoyaktuk Peninsula (Kugmallit Bay coast) and eastern Tuktoyaktuk Peninsula (Hutchison Bay to McKinley Bay) were examined. Six, 15 and 13% of stomachs respectively were empty. The results of stomach analyses are displayed in Table 29 and Fig. 32.

Fish, Isopoda and Amphipoda accounted for 30, 27 and 12% of the total dry weight of stomach contents respectively of fourhorn sculpins from Richards Island. Amphipoda however occurred in the greatest number of stomachs (73%) followed by Isopoda (60%), plant remains (40%) and Pelecypoda (33%).

Fish occurred in one-third of the stomachs and constituted 52% of the dry weight biomass of contents of fourhorn sculpins from the Kugmallit Bay coast. Isopoda, the only other organism that contributed significantly to the stomach content biomass (38%) occurred in 41% of the stomachs analyzed. Other organisms which occurred frequently in stomachs but contributed little to the dry weight were Amphipoda, plant remains and Mysidacea.

Fish occurred in 19% of the stomachs and constituted only 11% of the dry weight of the diet of fourhorn sculpins from the region to the east of Kugmallit Bay (Hutchison Bay to McKinley Bay). Fish identified as prey were fourhorn sculpins. Isopoda occurred in the greatest amount (60% of dry weight) while Amphipoda, plant matter, Isopoda and Mysidacea occurred in the greatest proportion of stomachs analyzed (67, 63, 48 and 37% respectively). Sculpins from this area had the greatest mean dry weight of food per stomach, at 1.04 gm/stomach whereas their mean size was only slightly larger than those from Kugmallit Bay but smaller than those from Richards Island which were analyzed (total length=233 mm, SD=36.8 compared to total length=237 mm, SD=45 for Richards Island, total length=219 mm, s=47 for Kugmallit Bay).

There is general agreement on the importance of benthic and epibenthic crustaceans to the diet of fourhorn sculpins (Griffiths et al. 1977; Craig and Haldorson 1981; Jones and Den Beste 1977; Kendel et al. 1975; Percy 1975). However, the large proportion of fish in the diet of particularly the Kugmallit Bay sample has not previously been reported from the western Arctic. Nor has the occurrence of pelecypods in fourhorn sculpin diet been reported in the western Arctic outside the Mackenzie estuary.

Arctic flounder, Liopsetta glacialis (Pallas)

Seasonal geographic distribution, abundance and sexual maturity:

JUNE/JULY: Arctic flounders accounted for 16.6, 53.0 and 15.5% of the total spring estuarine catch for 1978, 1979 and 1980 respectively (Table 9). The species was caught at one-third of the coastal locations fished during the three spring surveys; however large catches at Loc. 31 and 32 (McKinley Bay) in the late spring/early summer (20 July) of 1979 account for the numerical importance of this species in the spring catch statistics.

Arctic flounders were absent from locations within the inner estuary (Fig. 19) where the water was comparatively warm, of low salinity (0.5) and turbid. Salinity at locations where this species was caught in the spring ranged from 1-31.

Arctic flounder juveniles were not caught in seines during the spring survey of 1978 at locations along the Tuktoyaktuk Peninsula. In 1979 however, the later (20 July) seining efforts at McKinley Bay produced juveniles which ranged in size from 38-90 mm (n=22). These flounders were of three size groups (38-41 mm, 50-52 mm, and 90 mm). On the basis of young-of-the-year aging by Percy (1975) and aging of 2- and 3-year-old flounders from 1979 gill net samples (Table 30) it seems likely that these groups represent 0+, 1+ and 2+ year old fish respectively. A single 31 mm specimen was taken at Loc. 22 during the July 1979 survey, and eight juvenile Arctic flounder ranging in length from 38-52 mm were seined at locations along the Richards Island coast in 1980.

Working in the Tuft Point area, Jones and Den Beste (1977) reported catching a single young-of-the-year Arctic flounder, 14 mm in total length. Percy (1975) reported summer young-of-the-year attaining lengths of from 46-58 mm (n=7). The smallest Arctic flounder taken during our study was 31 mm. The large difference between the size of young-of-the-year flounder reported by the three studies may be due to different spawning times of adults and consequently different hatching times of larvae. For example in Kukjuktuk Bay, Arctic flounder were found in spent condition as early as mid-March of 1978 , whereas in 1979 they were still in ripe condition as late as June (Fallis, personal communication). Given the wide range of environmental conditions that present themselves to fish populations inhabiting the Mackenzie estuary (both between locations and between years), species which spawn within the estuary may find adaptive advantage in a protracted spawning period.

Alternatively, discrepancies in aging and in identification of the two flounder species present in the area may account for the wide range of growth rates reported. Starry flounders, Platichthys stellatus (Pallas) spawn later in the season (June) and consequently the natal year class would be considerably smaller than the natal year Arctic flounder.

Male:female ratios of Arctic flounder (Table 31) varied widely depending upon a variety of poorly understood factors. For example, the June 1978 Tuktoyaktuk coastal survey produced 69 females (all immature) but no male fish. In contrast, on 15 March 1978 at Kukjuktuk Bay, of more than 200 Arctic flounder caught less than 1% were females (Fallis, personal communication).

Whether there is segregation of sexes as a result of differences in the timing of onshore/offshore spawning movements is not known. The 20 July 1979 male to female ratio at McKinley Bay (Loc. 31 and 31A) approached 50:50.

AUGUST: Arctic flounder accounted for 23.4, 27.4 and 11.8% of the midsummer coastal catch for 1978, 1979 and 1980 respectively. They were the most abundant species netted with a mean CUE of 2.37 fish per hour (within a range of 0.14-20.0 fish per hour). They also had a high frequency of occurrence, particularly along the Tuktoyaktuk Peninsula east of Loc. 10 (Fig. 19). As in the spring, few specimens were caught along the Kugmallit Bay coast. They were most frequently caught in brackish water with salinity in excess of 10.

Seine catches of Arctic flounder juveniles were most abundant during this midsummer period. Catch locations were outside the Kugmallit Bay area and included the northern inlets of Richards Island, both Pullen and Hooper Islands, and locations as far east as Loc. 38. A single juvenile Arctic flounder (59 mm, 1+ year old) was caught in the upstream hoopnet at Loc. 62 (Table 23).

Sexually mature Arctic flounder, the youngest of which was 7 years and the oldest 23 years, accounted for 26% of the catch of this species in the summer of 1978. While males overall represented 54% of the Arctic flounders, the male:female ratio in catches was highly dependent on the location of capture as was the proportion of sexually mature fish. For example, the 1978 catch from Loc. 21 and 22 (Hutchison Bay) combined (n=36) had 92% sexually mature fish. Of these only 19% were males.

SEPTEMBER: Arctic flounders decreased in both abundance and distribution during the fall survey. This species represented 11.4, 0 and 13.3% of the total coastal fall catch of 1978, 1979 and 1980 respectively (Table 9, Fig. 19). The absence of Arctic flounder from the 1979 catch was a result of the lack of fishing effort outside Kugmallit Bay.

Salinity at the Richards Island locations where Arctic flounder were caught, ranged from 16-30 while in 1978 along the Tuktoyaktuk Peninsula salinity ranged from 10-30 at catch locations. One Arctic flounder was caught at Loc. 1 in 1980 where the salinity was 4.

No juvenile Arctic flounder were caught in seines along the Tuktoyaktuk Peninsula coast in the fall of 1978. In 1979, a single juvenile (total length=63 mm) was caught in a hoop net at the Loc. 31 stream site.

The sexual condition of Arctic flounders from the fall survey of 1978 was examined (Table 31). These data indicated that a larger proportion (52%) of the flounders were sexually mature than the case during the midsummer. As with the midsummer survey, the samples from Loc. 21 and 22 (combined n=34) had the largest proportion (79%) of mature fish.

Jones and Den Beste (1977) reported 5- and 8-year-olds as being the youngest male and female spawners respectively. In the present study the youngest sexually mature Arctic flounders were 7 years old with a minimum total length of 190 mm. However most exceeded 200 mm; corroborating Percy's (1975) observations.

Overwintering and spawning: Arctic flounder are known to spawn in March in Kukjuktuk Bay (Fallis, personal communication). Percy (1975) reported overwintering Arctic flounders (n=4) in Mallik Bay (Loc. 83).

Length- and age-frequency distribution: Arctic flounder gillnet catch summary statistics of the open water surveys conducted between 1978 and 1980 are shown in Table 32. Age and length distributions are presented in Fig. 33-36.

Seven- to 9-year-old fish were dominant in the 1978 and 1979 Arctic flounder samples from Tuktoyaktuk Peninsula, which ranged in age from 3-26 years (Fig. 33 and 34). They ranged from 79-327 mm total length, with the modal length interval at 226-275 mm (Fig. 36). An increase in the size of Arctic flounders from the Tuktoyaktuk Peninsula was observed between the spring and fall surveys. Percy (1975) reported that the majority of gillnetted Arctic flounder from the outer Mackenzie Delta were in the 200-300 mm length interval. Although this species rarely exceeds 350 mm total length (Morrow 1980), a 440 mm individual caught by Percy (1975) appears to be the largest recorded; its age was not determined.

Whereas 5- to 7-year-old Arctic flounder were the most frequently occurring in Percy's (1975) sample from outer delta locations, Jones and Den Beste (1977) reported as do we, that most Arctic flounders from the Tuft Point area (Loc. 19, Fig. 1) to be from 7-9 years.

A greater proportion of larger Arctic flounder were caught at the Richards Island locations than along the Tuktoyaktuk Peninsula (Table 32).

Age-length relationship: The age-length relationships for Arctic flounder are presented in Fig. 37 and Table 30. Little growth occurred past an age of 12-13 years.

The growth curves from 1978 and 1979 suggest that 1979 Arctic flounder were longer for any given age. The explanation may be that the majority of the 1978 samples were collected in the latter part of the summer after a discernable annulus was laid down on the otolith whereas the 1979 sample was taken earlier in the summer, prior to the formation of a detectable annulus.

During 1980, Arctic flounder from the spring survey only were aged. None were less than 6 years old. By inference from their lengths, Arctic flounder of similar ages were caught in mid- and late-summer surveys (Table 30).

Female Arctic flounder grow faster than males. The difference in mean fork length between males and females from mid-summer 1978 were significant ($p<.05$) at 7, 8 and 10 years (Table 33, Fig. 37).

Growth of the Arctic flounder from the southeastern Beaufort Sea is comparable to that in the Barents Sea (Andriyashev 1954) where 9+ females attain an average total length of 249 mm. Age-length relationships reported by others (Percy 1975; Griffiths et al 1977; Griffiths et al. 1975) are similar to the findings of the present study.

Food habits: Stomachs of Arctic flounder along the Tuktoyaktuk Peninsula and in bays of the Richards Island coast were examined. All of the fourteen Richards Island fish examined had food in their stomachs, and only 18% of the 106 Tuktoyaktuk Peninsula fish stomachs were empty. The contents of stomachs from both areas were analyzed and the results are shown in Fig. 38 and Table 34.

Pelecypoda was the major food item in the stomachs of the Richards Island flounders, representing 63% of the total dry weight stomach contents and occurring in 79% of the stomachs which had food. Amphipoda, found in 57% of stomachs, accounted for less than 1% of the dry weight biomass. Few other identifiable food organisms occurred in more than one stomach, nor contributed significantly to total stomach content weight. The exceptions, Ascidiacea and Polychaeta occurred in one and two stomachs respectively and accounted for 15% of the dry weight contents.

Pelecypoda accounted for 84% of the total dry weight in Arctic flounder stomachs from the Tuktoyaktuk Peninsula coast. They occurred in 54% of the stomachs with food and were the dominant food item in all but one location (Loc. 32) where plant remains superceded Pelecypoda in importance. Plant material was overall second in importance to the Arctic flounder stomach samples, occurring in 61% of stomachs and accounting for 3% of the total dry weight.

Other food organisms which occurred with moderate frequency were Priapulida, Amphipoda and Oligochaeta. These (combined), accounted

for only 2.4% of the total dry weight biomass of the stomachs.

The diet of Arctic flounder reported by Percy (1975) and Jones and Den Beste (1977) was similar to findings of this study.

Craig and Haldorson (1981) reported that Pelecypoda (the mainstay of the Arctic flounder diet along the Tuktoyaktuk Peninsula coast) were not present in the stomachs they examined from Simpson Lagoon. Rather, Amphipoda, Isopoda, fish, Polychaeta and Mysidacea accounted for 58, 30, 7, 3 and 1% of content composition (Hynes Point Method). Whether this reflects differences in food availability or feeding preference is not known.

Starry flounder Platichthys stellatus (Pallas)

Seasonal geographic distribution, abundance and sexual maturity:

JUNE/JULY: Starry flounders were caught at 34% of the locations fished and represented 7.7, 11.1 and 3.2% respectively of the total spring coastal catch of 1978, 1979 and 1980 (Table 9). Along the Tuktoyaktuk Peninsula, they ranked third in abundance among marine fishes, behind Arctic flounders and fourhorn sculpins. Along the Richards Island coast catches during the spring were few (n=9) and scattered (Fig. 20). Overall, the mean spring catch per unit effort (CUE) was 1.76 fish per hour (Table 20).

The geographic distribution of this flounder was similar to that of the Arctic flounder. They demonstrated a wide salinity tolerance, being caught at locations with salinity ranging from 1-29. The largest catches were made between salinity 3.7-8.0. The species is commonly taken at salinities of 6-10 in California (Hart 1973).

No juvenile starry flounders were seined during the spring surveys.

One third of the starry flounder from the 1980 spring survey were in spawning condition (Table 35); these were caught at both Mason Bay (Loc. 60) and in Canyanek Inlet (Loc. 1). In 1978, slightly more than one half of the spring catch were in a ripe condition, most of which were caught at Loc. 21 (Hutchison Bay). Two starry flounders from this location were spent. The smallest ripe fish was 215 mm.

All starry flounders caught in the 1979 spring survey (three weeks later than in 1978) were immature, and there was some evidence that sexes tended to segregate, as with the Arctic flounder. For example, all starry flounders at Loc. 22a were males ranging in age from 10-24 years.

AUGUST: Starry flounders represented 6.1, 17.5 and 1.3% of the total midsummer coastal catches of 1978, 1979 and 1980 respectively. As with the spring survey, they were more widely distributed along the Tuktoyaktuk Peninsula coast than along Richards Island (Fig. 20). Starry flounder were caught at 37% of the locations fished (Table 20) with a mean CUE of 1.30 fish per hour. Starry flounders did not range as far east (outer estuary) as Arctic flounders. Catches were made at Richards Island locations which had salinity ranging from 10-14. Tuktoyaktuk Peninsula catch locations ranged in salinity from 4-25.

Juvenile starry flounders were taken at three locations on the Richards Island coast (Fig. 20). Virtually all starry flounders caught along the Tuktoyaktuk Peninsula in 1978 and 1979 were immature (Table 35). Four sexually mature females, taken at Loc. 22 ranged in size from 212-282 mm; the youngest specimen was 6 years old.

SEPTEMBER: Starry flounders represented a small proportion of the fall coastal catch in 1978, 1979 and 1980 (1.7, 2.5 and 0.2% respectively). The species was caught at few of the locations fished and the mean CUE was 0.53 fish per hour (Table 20, Fig. 20). Only one specimen was taken at Richards Island locations in 1980, and along the Tuktoyaktuk Peninsula in 1978 and 1979 catches were small and sparsely distributed. It would appear that the fall coastal survey during each year took place subsequent to offshore migration of the starry flounder, or else they were more sedentary during this period. Salinity at locations of capture ranged from 16-30.

The 1978 fall sample contained a larger proportion of sexually mature fish than did the midsummer sample.

No juvenile starry flounders were taken in the fall seining.

Overwintering, spawning and migration summary: Starry flounders probably overwinter in offshore locations as well as in a number of suitable deeper bays such as Mallik Bay (Percy 1975). In June they move to inshore areas to spawn in habitat similar to that utilized by Arctic flounder from March through May.

On the basis of 1978 and 1979 data, it appears that starry flounder spawn in bays and inlets along the coast from late June to early July. It is not known whether the starry flounders caught in the latter part of July 1979 were post spawners or non-spawning fish which had migrated from offshore. Starry flounders along the Pacific coast make seasonal inshore/offshore migrations (Morrow 1980).

Starry flounders appear to have adapted to spawning at colder temperatures in the Beaufort Sea than elsewhere where the height of spawning by starry flounders is reported to occur at water temperatures of 11°C (Orcutt 1950; Andriyashev 1954). In the present study ripe and spent starry flounders were caught (in 1978) at temperatures ranging from 1.9-3.4°C, and (in 1980) at temperatures from 1.5-6.8°C.

Following spawning, there appears to be an inshore migration of non-spawning adults. Whether the starry flounder then move offshore in the fall to overwinter, or congregate in deeper bays and inlets, or both, is unclear. Certainly, nearshore shallow-water gillnet catches decrease in the fall. In Tuktoyaktuk

Harbour, increased deepwater bottom trawl catches in late summer accompanied the decrease in nearshore gillnet and trap net catches (Hopky and Ratynski 1983), which would indicate a movement from shallow to deeper areas by this species in the fall.

Length- and age-frequency distribution: Gillnet catch summary statistics for starry flounders are presented in Table 36. Those caught along the Tuktoyaktuk Peninsula ranged in total length from 152-337 mm, while from Richards Island they all exceeded 214 mm. Starry flounders from the Tuktoyaktuk Peninsula coast ranged in age from 4-27 years (n=122), and those from Richards Island ranged from 12-20 years (n=7).

The length frequency distribution of this species along Tuktoyaktuk Peninsula varied little seasonally or annually (Fig. 39). Approximately 40% of the sample were fish in the 250-275 mm interval. Flounders greater than 275 mm accounted for less than 20% of the catch. The age-frequency distribution for starry flounders is presented in Fig. 40.

Age-length relationship: Slow growth and long life characterize starry flounder in the Beaufort Sea. An average increase of only 8-10 mm per year was observed between age 5 and 12. Beyond 12 years the annual growth increment was even less. Morrow (1980) reported that starry flounder from the northern British Columbia coast grew as much as 25 mm per year. He also reported that females grew faster than males, a phenomenon observed during the present study. Growth data for the starry flounders are presented in Table 37, Fig. 41.

Food habits: A total of 69 starry flounder stomachs from the Tuktoyaktuk Peninsula coast were examined. Twenty-six percent were empty; the remainder (51) were analyzed (Table 38 and Fig. 42).

Pelecypoda were found in 61% of stomachs with food and accounted for 63% of the dry weight biomass. Of less significance were plant material, Amphipoda, Isopoda, Priapulida and Polychaeta. These occurred in 59, 45, 24, 25 and 10% respectively of the stomachs, and combined, accounted for 17% of the dry weight contents. The mean dry weight of stomach contents (n=51) was 1.09 g. The comparatively high stomach content biomass was in part a reflection of heavy feeding at two locations sampled in 1978 (Loc. 23 and 33), and in part due to the weight of pelecypod shells which were included in the dry weight determinations.

Starry flounders from southern Kugmallit Bay were found to be feeding primarily upon Isopoda which accounted for 37% of the dry weight biomass (Table 38). Pelecypoda, so prominant in the diet of northern Tuktoyaktuk Peninsula flounders, occurred in only one stomach. Sixty percent of the stomach contents of these fish was unidentifiable.

Little information has been published regarding the food habits of northern-dwelling starry flounder. Galbraith (1975), Percy (1975) and Jones and Den Beste (1977) reported a greater utilization of Crustacea by starry flounder than was found in the present study.

Pacific herring, Clupea harengus pallasi Valenciennes

Seasonal geographic distribution and life history information:

JUNE/JULY: Pacific herring were caught at few locations and in small numbers, representing 0.7, 0.8 and 4.6% of the spring coastal catch in 1978, 1979 and 1980 respectively (Table 9, Fig. 21). Pacific herring were slightly more abundant along the Richards Island coast than along Tuktoyaktuk Peninsula.

Most spring-caught herring from 1980 were spent fish (Table 39) ranging in age from 7-13 years and were from 274-322 mm fork length (Table 40). Those from the 1978 spring survey were in ripe condition.

Pacific herring which spawn in the Mackenzie estuary do so under the ice of early June to early July. Fallis (personal communication) reported ripe herring in early to mid-June in Kukjuktuk Bay with a progressively higher proportion of spent herring by late June.

No juvenile Pacific herring were caught in seines during any of the spring surveys.

AUGUST: In midsummer, the Pacific herring were more abundant and more widespread than during the spring survey (Fig. 21). Herring at this time accounted for 2.6, 6.8 and 3.9% of the total coastal catch (Table 9) in 1978, 1979 and 1980 respectively and were caught at 43% of the locations fished. Their occurrence within the study area ranged from mildly brackish water of Kugmallit Bay to the more marine environment at Russell Inlet (Loc. 40-45).

Pacific herring caught during the midsummer surveys ranged in age from 2-15 years and in size from 86-334 mm fork length (Table 40). Ninety-one percent of the herring caught along the Tuktoyaktuk Peninsula in August were >200 mm long and were six or more years old (Fig. 43 and 44). Percy (1975) reported a similar length- and age-frequency distribution in the outer Mackenzie Delta. In 1980, the majority of the Richards Island midsummer herring catch (n=12) were under 200 mm long and were 3 or 4 years old. All were taken in a single net set at Loc. 63. Pacific herring of this size range have not been commonly encountered, but were also caught by Hopky and Ratynski (1983) in Tuktoyaktuk Harbour in July.

Only one juvenile herring (51 mm fork length) was caught in seines during the midsummer survey.

SEPTEMBER: Pacific herring were most abundant during the fall survey at which time they accounted for 3.3 and 10.9% of the catch in 1978 and 1980 respectively. No Pacific herring were caught in the 1979 fall coastal survey conducted at Loc. 1 and 4. Catches per unit effort at Richards Island locations were greater than

along Tuktoyaktuk Peninsula where Pacific herring were not caught east of McKinley Bay (Table 20, Fig. 21). Salinity ranged from 12-30 at Richards Island locations and from 13-29 at Tuktoyaktuk Peninsula locations where herring were caught.

Pacific herring from the Tuktoyaktuk Peninsula coast in 1978 ranged from 95-343 mm fork length (Table 40), with males 276-300 mm and females 301-325 mm dominating the size distribution (Fig. 43). Ten-year-old fish dominated both sexes (Fig. 44). Seventy-one percent of the herring were mature (Table 39), the youngest of which was 7 years old.

Pacific herring from the Richards Island coast were of similar size and age range as those from the Tuktoyaktuk Peninsula; however, a greater proportion were in the 276-300 mm size class (Fig. 43), the majority of which were sexually maturing.

Juvenile Pacific herring seined in September at Loc. 23 had a mean fork length of 37 mm (n=16, range=24-44 mm). Jones and Den Beste (1977) captured seven young-of-the-year at nearby Tuft Point (Loc. 19) in the summer of 1976. They were of similar size, measuring 27-38 mm in fork length.

Winter gonad development: Ovaries of Pacific herring which were sampled in September 1980, ranged from 3.6-5.7% of the body weight (mean=4.7%, SD=0.95%, n=4). By March of 1981, Pacific herring ovaries had increased to between 11.7 and 15.2% of body weight (mean=13.7%, SD=1.09%, n=4).

Age-length relationship: The age-length relationships for Pacific herring caught during 1978 to 1980 are presented in Table 41 and Fig. 45.

The infrequency with which herring less than 250 mm (6 years or younger) were caught did not permit the satisfactory determination of an age-length relationship for this species. What is apparent is that Pacific herring from the region display highly variable growth rates, live long (19 yr), but grow little beyond the eighth or ninth year. The difference in growth rate between males and females was not significant. Growth rates were similar to that reported by Riske (1960).

Food habits: A total of 65 Pacific herring stomachs were examined. Sixty-two percent of the stomachs were empty. The mean dry weight of contents which were analyzed (n=10) was 0.12 g, 66% of which was unidentifiable remains (Fig. 46, Table 42). Copepoda, plant material, Foraminiferida and Mysidacea were the only food items of measurable biomass, accounting for 29, 2, 2 and 1% by weight of the stomach contents respectively. Plant material and Copepoda occurred in 60 and 30% of the stomachs respectively.

Kendel et al. (1975) in studies along the Yukon Coast, found that the four Pacific herring stomachs they examined contained only mysids. Percy (1975) observed that of twenty stomachs examined the seven which contained food had Mysidacea, Copepoda and Amphipoda. He reported that four specimens caught in March were feeding exclusively on Amphipoda.

Riske (1960) reported Pacific herring to be plankton feeders throughout life. This does not appear to hold true for Beaufort Sea fish. Our analysis of Pacific herring feeding habits indicates a diverse diet consisting of benthic infaunal organisms (Pelecypoda, Acarina, Nematoda, and Chironomida larvae) as well as epibenthic and planktonic organisms.

Saffron cod, Eleginus gracilis (Tilesius)

Seasonal geographic distribution, abundance and sexual maturity:

JUNE/JULY: Saffron cod comprised 0.2, 1.4 and 3.2% of the 1978, 1979 and 1980 gillnet catches respectively (Table 9). This species was caught at few locations (Fig. 22) and at a comparatively low CUE of 0.49 fish per hour (Table 20). Salinity at which catches were recorded ranged from 1.1-8.0 with the largest catches occurring at salinities between 4 and 8.

No saffron cod were caught within the fresher, more turbid areas of Kugmallit Bay, and no juvenile cod were taken in seine hauls at any location during the spring.

Saffron cod from the June/July surveys were all immature (Table 43) whereas Fallis (personal communication) found mature, ripe and spent saffron cod at Kukjuktuk Bay in mid-March.

AUGUST: Saffron cod represented 2.9, 4.8 and 7.2% of the midsummer gillnet catches of 1978, 1979 and 1980 respectively. Their distribution was considerably more widespread at this time than during the spring survey, however they were still absent from Kugmallit Bay catches (Fig. 22). The CUE for saffron cod was approximately double that in the spring as was their frequency of occurrence. Locations where they were caught ranged in salinity from 10-27. Seining during this survey produced no juvenile fish however one adult saffron cod was seined from the south shore of Pullen Island (Loc. 82).

All saffron cod from the August Richards Island (1980) survey were immature whereas 5 and 33% of the 1978 and 1979 Tuktoyaktuk Peninsula saffron cod respectively were mature (i.e. next winter's spawners).

SEPTEMBER: The fall distribution of saffron cod was similar to that of midsummer. Except for a single saffron cod caught at Loc. 8, they were absent from the Kugmallit Bay gillnet catches. Saffron cod were caught (mean CUE=0.83 fish per hour) at locations where salinities ranged from 6.4-33 and seining once again produced no saffron cod juveniles.

As in the midsummer survey, no mature fish were caught at any of the Richards Island locations, whereas the catch along Tuktoyaktuk Peninsula in September 1978 included 36% mature fish (Table 43).

Age at maturity and spawning locations: Sexually mature saffron cod ranged in age from 6-19

years. This is considerably older than the 2-3 year age at sexual maturity reported for this species in the White Sea (Andriyashev 1954). Our data include only sparse numbers of cod under 6 years old, hence it is not certain that 3-year-old Beaufort Sea saffron cod do not spawn. Jones and Den Beste (1977) reported sexually mature saffron cod ranging from 5-10 years of age.

Both Jones and Den Beste (1977) and Percy (1975) reported a preponderance of males in their samples (91% and 76% respectively). Male: female ratios reported in our catches (Table 43) cover a wide range, with neither sex consistently dominant. Overall, 52% of the sample (n=180) were males.

Kukjuktuk Bay is considered a likely location for March/April spawning for this species (Fallis, personal communication). Along the southwest Alaska coast saffron cod are reported to seek coastal waters for spawning in the December - February period (Morrow 1980) as they do also in the White Sea (Andriyashev 1954). Tuktoyaktuk Harbour is also a suspected spawning and nursery area. Numerous 1-year-old saffron cod have been caught in trap nets there (Hopky and Ratynski 1983), and saffron cod fry were taken in ichthyoplankton tows (Ratynski 1984). Other attempts to sample juvenile and young-of-the-year saffron cod in the Mackenzie estuary have been largely unsuccessful. Jones and Den Beste (1977) reported a single young-of-the-year being caught in midsummer near Tuft Point (Loc. 18, Fig. 1). Percy (1975) captured no juvenile saffron cod in the outer Mackenzie Delta, similarly none resulted from our efforts. The absence of juveniles from samples may be the result of the following factors: (1) Gear selectivity. Cod, particularly juveniles, appear to be relatively immune to gillnet capture (Craig and Haldorson 1981), a phenomenon which was confirmed by Hopky and Ratynski (1983). (2) Larval development. Saffron cod larvae likely emerge in April/May based on spawning in March and a 40-48 day incubation (Morrow 1980). They then lead a planktonic existence for 2 to 3 months. Ratynski (1984) reported young-of-the-year saffron cod in Tuktoyaktuk Harbour to have attained a length of 7.5 mm by mid-August. Consequently it is probable that those young-of-the-year cod that might inhabit the very nearshore areas during the periods when seining took place, were too small to be caught by the nets used.

Overwintering: Saffron cod have been captured in Tuktoyaktuk Harbour in March (Bond et al. 1982) and in Kukjuktuk Bay in the same month (Fallis, personal communication). Other nearshore locations which appear to have suitable overwintering habitat are: Mason Bay (Loc. 60, 62, 63), north east Richards Island and McKinley Bay (Loc. 31, 31a).

Length- and age-frequency distribution: Saffron cod gillnet catch summary statistics are shown in Table 44. The age- and length-frequency distribution did not vary from one survey period to another and hence seasonal data from each year were pooled. (Fig. 47 and 48).

Ninety-eight percent of the saffron cod caught along the Richards Island coast were from 376-475 mm long. Percy (1975) found a similar distribution. The length distribution of saffron cod from the Tuktoyaktuk Peninsula coast differed from the Richards Island sample in that a greater proportion of smaller fish were present (Fig. 48).

The Richards Island saffron cod ranged in age from 6-19 years. They had a bimodal age-frequency distribution with modal ages of 7 and 12. Tuktoyaktuk Peninsula fish ranged from 3-16 years, with 11-year-olds being the dominant age class.

Age-length relationship: The age-length relationships of saffron cod caught in 1978, 1979 and 1980 presented in Table 45 and in Fig. 49.

Saffron cod of the region do not appear to grow notably beyond the age of 10 years. The age-length relationships reported by Percy (1975), Jones and Den Beste (1977) and Andriyashev (1954) coincide well with those determined here. Unfortunately, only few young-of-the-year have been recorded from this study area and depending upon location, first-year growth rates varied greatly. Jones and Den Beste reported capturing a 34 mm young-of-the-year at Tuft Point (Loc. 18, Fig. 1 on August 1 whereas Ratynski (1984) reported a range in length from 5.6-8.0 mm for young-of-the-year saffron cod taken from the marine environment of Tuktoyaktuk harbour between mid July and mid August. We have found that 80-120 mm long saffron cod from Tuktoyaktuk Harbour range in age from 2-3+ years.

The rate of growth of saffron cod under age 7 is somewhat slower in this region than that reported for southwestern Alaska waters where they are reported to attain of 460 mm by age 7+ (Morrow 1980).

Food habits: Stomachs of saffron cod from the coastal bays of Richards Island, west Tuktoyaktuk Peninsula (east coast of Kugmallit Bay) and east Tuktoyaktuk Peninsula (Hutchison Bay to Cape Dalhousie) were examined. Fourteen percent of the 51 stomachs from Richards Island were empty. None of the stomachs examined from the Tuktoyaktuk Peninsula were empty. Results of the stomach analyses are presented in Fig. 50 and Table 46.

While fish remains were the largest single contributor (26%) to the dry weight of stomachs from Richards Island, they were identified in only 20% of the stomachs analyzed (n=26). Fourhorn sculpins were the only identifiable fish found. Amphipoda, plant matter, Isopoda and Mysidacea occurred with greatest frequency and accounted for 12, 3 and 3% of dry weight respectively. Polychaeta occurred in 31% of stomachs and represented 9% of the total dry weight.

Saffron cod from the two regions of the Tuktoyaktuk Peninsula coast had similar food habits. Amphipoda, Isopoda, Mysidacea and fish were the most important food items, accounting for the majority of dry weight biomass and were found in a large proportion of the stomachs analyzed. Polychaeta were absent from their diet.

Percy (1975) examined 10 saffron cod stomachs from Mason Bay on the Richards Island coast. He reported a diet similar to our findings except that no fish remains were identified. The diet of saffron cod reported by Jones and Den Beste (1977) in studies in and near Kukjuktuk Bay included fish (fourhorn sculpin and unidentified coregonids), Isopoda, Amphipoda and Mysidacea in order of importance. Nine percent of the stomachs were empty.

Craig and Haldorson (1981) examined 33 winter caught saffron cod and reported three empty stomachs. The contents of those that were feeding were dominated by fish. Mysidacea and Decapoda also were present.

Arctic cod, Boreogadus saida (Lepechin)

Arctic cod were caught in gillnets on one occasion only (Loc. 20, 30 July 1978 (Fig. 106). They ranged from 94-133 mm in fork length (n=7). Beach seining produced only one specimen (81 mm long) at Loc. 80 on 7 July 1980 (Fig. 106).

Inappropriate gear vis-a-vis the generally pelagic nature of the species probably accounts for the low catch. Craig and Haldorson (1981) reported a dramatic increase in Arctic cod catch when they used fine meshed trap nets rather than gill nets. Based on studies conducted in and near Tuktoyaktuk Harbour, with otter trawls (Hopky and Ratynski 1983; Byers and Kashino 1980), it appears that Arctic cod do frequent the study area, however abundance is unknown.

It is suspected that Arctic cod are of much less ecological significance within the influence of the Mackenzie estuary than outside it.

Other marine species

No other marine species were caught in the course of our coastal surveys. However other marine fish (polar cod, eelpout and prickleback) are known to inhabit the coastal regions (Hopky and Ratynski 1983; Bond 1982; Galbraith and Hunter 1975).

Arctic cisco, Coregonus autumnalis (Pallas)

Seasonal geographic distribution, abundance, size distribution and sexual maturity:

JUNE/JULY: Arctic cisco comprised 8.7, 12.2 and 10.9% of the coastal gillnet catch during the spring surveys of 1978, 1979 and 1980 respectively (Table 10). Their distribution ranged from the northern end of Richards Island to the eastern side of McKinley Bay (Fig. 23). Arctic cisco were caught at 63% of the coastal locations fished with a mean CUE of 0.75 fish per hour within a range of 0.12-4.58 fish per hour (Table 21).

Arctic cisco ranged in age from 3-10 years and 1-10 years for 1978 and 1980 respectively. Those caught during the later spring survey of 1979 were smaller and younger (mean fork length = 201-289 mm; age range = 4-6 years) than those caught during the spring surveys of 1978 or 1980 (Table 47).

Seventy-five juvenile Arctic cisco ranging in fork length from 69-170 mm were caught in seines during the 1978 spring survey. Based upon the age-length relationship of this species (Table 48), 65% were 1-year-olds (51-100 mm length class, Fig. 51). By similar inference, 86% of the 1980 June/July seine catch (n=204) were one-year olds (51-125 mm length class). Those Arctic cisco in the 26-50 mm length class (n=20) were presumed to be young-of-the-year (mean fork length=35.9 mm, range=26-47 mm). The mean fork length of young-of-the-year caught on 19 and 20 July 1979 was 43 mm (n=83, range=31-62 mm).

Arctic cisco are believed to spawn in the Mackenzie River (or its major tributaries) upstream of the delta (Percy 1975; Stein et al. 1973a) and the young are then carried downstream to coastal areas in their natal year. It appears that the early timing (26-29 June) of the 1978 spring survey may have precluded young-of-the-year from beach-seine catches. The 1+ year old fish that were caught are suspected to have overwintered in the outer delta and along the coast within the freshwater influence of the Mackenzie River.

Sexually mature females (n=7) ranged in age from 6-9 years (Table 49). The majority were caught near the east channel of the Mackenzie River.

No Arctic cisco were caught in any of the freshwater lake systems which were sampled.

AUGUST: Arctic cisco represented 8.8, 11.1 and 9.5% of fish gillnetted during the August sampling period of 1978, 1979 and 1980 respectively (Table 9). They were caught as far west as Harry Channel (Loc. 78) and as far east as Johnson Bay (Loc. 53, Fig. 1). Sixty-two percent of the 60 locations fished produced Arctic cisco with a mean CUE of 1.13 fish (range = 0.15-3.38).

Overall, Arctic cisco from the midsummer surveys ranged in fork length from 101-414 mm and in age from 1-10 years (Table 47). The length- and age-frequency distributions of the August Arctic cisco samples are shown in Fig. 52 and 53.

The 1980 midsummer gillnetting at Richards Island caught a notable proportion of 1-year-old (101-125 mm) Arctic cisco. This size interval was not encountered along the Tuktoyaktuk Peninsula.

During the midsummer surveys, juvenile Arctic cisco were caught in seines at 19 coastal sites over a geographic range similar to that of the June/July survey (Fig. 23). Ninety-three percent of juveniles (n=41) seined in midsummer 1978 were presumed to be young-of-the-year (mean fork length=46.8 mm, SD=6.4 mm, range=35-65 mm) (Fig. 51). The mean fork length of young-of-the-year seined during midsummer 1979 was 53.5 mm (range=29-63, n=65). Sixty-nine percent of Arctic cisco caught in seines along the Richards Island coast during the same period in 1980 were young-of-the-year. The mean fork length of the measured subsample was 50.1 mm (SD=8.8, n=102).

Four percent of Arctic cisco from the mid-summer gillnet surveys were sexually mature.

SEPTEMBER: Arctic cisco comprised 27.3, 22.8 and 11.1% of the coastal catch of 1978, 1979 and 1980 respectively. Eighty-two percent of the locations fished produced Arctic cisco with a mean CUE of 2.4 fish (range=0.4-8.3). Once again Arctic cisco occurred over the full geographic range of sampling locations (Fig. 23).

Arctic cisco caught in the 1978 fall survey ranged in fork length from 115-432 mm (Table 47). However, the length distribution of Arctic cisco was dependant upon the location of capture. In the Kugmallit Bay region from near East channel (Loc. 1) to Tuft Point (Loc. 21) the length distribution was bimodal, with modal fork length intervals of 175-225 mm and 301-350 mm (Fig. 54). The age structure likewise was bimodal, age-4 and age-7 fish being the dominant classes (Fig. 55). Beyond Tuft Point (from Hutchison Bay to Cape Dalhousie) the length distribution was unimodal, with fish less than 226 mm fork length absent from all catches (Fig. 54) and 7-year-old fish the dominant class (Fig. 55). The absence of smaller Arctic cisco from the fall samples from eastern Tuktoyaktuk Peninsula is unexplained; however, it appears to be a seasonal phenomenon as 15% of the midsummer catch from that area were less than 226 mm fork length.

The 1979 fall coastal fishing was done at Loc. 1 and 4 only. Eighteen Arctic cisco were caught which ranged in age from 6-9 years.

Arctic cisco caught during the Richards Island coastal survey in the fall of 1980, were considerably smaller and younger than those caught at a comparable time along the Tuktoyaktuk Peninsula coast in 1978 (Fig. 52, 53). Catches on the western side of Richards Island were larger in number than elsewhere and were comprised almost entirely of 2- and 3-year old fish.

Ninety-eight percent of the juvenile fish seined along Tuktoyaktuk Peninsula in the fall of 1978 were young-of-the-year with a mean fork length of 54.7 mm (SD=8.1, n=43, range=37-68). Arctic cisco juveniles seined in the fall of 1980 at Richards Island coastal sites ranged in fork length from 40-155 mm (n = 71). Fifty-eight percent were less than 75 mm long and were probably young-of-the-year (Fig. 51). No measurements were made of the few Arctic cisco taken in the fall of 1979.

Summer growth of young-of-the-year Arctic cisco was rapid. During the 2-2 1/2 month period from the end of June to mid-September the 0+ fish grew from approximately 35 mm to about 60 mm (Fig. 56). Over the next 9-10 months Arctic cisco juveniles increased another 30 mm in length.

All the Arctic cisco gillnet sample from the fall 1980 survey were immature, whereas 67% of the 1979 fall catch (n=18) were mature but probably would not have migrated to upstream Mackenzie River spawning areas until the following spring or summer. Five percent of the 1978 fall survey sample of Arctic cisco (n=329) were mature (Table 49).

Spawning: The vast majority of adult Arctic cisco caught along the Tuktoyaktuk Peninsula coast and along the Richards Island coast were non-spawners. These fish represent a major non-spawning portion of the Mackenzie River Arctic cisco population, the spawning segment of which begins its upstream spawning migration soon after or during breakup (Hatfield et al. 1972; Stein et al. 1973b). The Arctic cisco caught within, and upstream of, the Mackenzie Delta throughout the summer by Stein et al. (1973b) were all mature spawning adults, 7 years and older. Those sexually mature fish which were caught during our spring and mid-summer surveys of 1978 through 1980 may have been stragglers of the larger spawning group which departed the coast during break-up.

There is no evidence that Arctic cisco spawn or overwinter in the small lakes and streams of Richards Island and Tuktoyaktuk Peninsula. Only one occurrence of juvenile Arctic cisco, was reported (but not confirmed) from a small Tuktoyaktuk Peninsula stream (Loc. 22a). Whether large rivers of the area (other than the Mackenzie River) such as the Anderson River support a spawning population of Arctic cisco is not known.

Overwintering: Arctic cisco overwinter in bays and lagoons of Richards Island (Percy 1975) as well as in Kugmallit Bay where they we caught them 6 km offshore in April 1980 at which time the salinity ranged from 0.1-4.7. Arctic cisco were also caught in January and March 1981 in Tuktoyaktuk Harbour (Bond 1982) at which times salinity ranged from <1-20. Craig and Haldorson (1981) also report tolerance by Arctic cisco to a wide range of salinities in their overwintering habitat in the Colville estuary.

Age-length relationship: Data for Arctic cisco from Richards Island (1980) and from Tuktoyaktuk Peninsula (1978 and 1979) are presented in Fig. 57 and Table 48. Increase in fork length with age was greatest from age 1-7. The growth of Arctic cisco in the southeastern Beaufort Sea was similar to that reported in other western Arctic studies (Fig. 58).

While there appeared to be some trend toward females being larger at a given age than males (Table 49), only in 6- and 7-year old fish was the difference significant ($p \leq .05$).

Food habits: The stomach content analyses of Arctic cisco from coastal locations of Richards Island, west Tuktoyaktuk Peninsula (Bay 1 to Kukjuktuk Bay) and east Tuktoyaktuk Peninsula (Bay 20 to Bay 53) are displayed in Table 51 and Fig. 59.

Sixty-eight percent of Arctic cisco stomachs from the Richards Island coast (n=71), 70% from west Tuktoyaktuk Peninsula (n=60) and 33% from east Tuktoyaktuk Peninsula (n=81) were empty.

Arctic cisco stomachs from the west Tuktoyaktuk Peninsula coast (Kugmallit Bay) contained on the average 0.04 grams of dry weight material. The diet of these fish was represented primarily by Copepoda, fish, plant material, Pelecypoda and insect larvae.

Stomachs of Arctic cisco caught along the eastern portion of Tuktoyaktuk Peninsula contained a greater diversity of organisms and were on the average fuller (0.13 g dry weight per stomach) than were those of Kugmallit Bay. Copepoda, fish, Amphipoda and Mysidacea accounted for most of the stomach contents (55.3, 8.2, 4.2 and 2.3% by weight respectively). Mysidacea, Copepoda and Amphipoda were the most frequently occurring organisms, found in 29, 27, and 22% of the stomachs respectively. Jones and Den Beste (1977) reported a similar diet in Arctic cisco from the Tuft Point, Kukjuktuk Bay area (Loc. 17-19, Fig. 1).

In studies along the Yukon coast (Kendel et al. 1975; Craig and Mann 1974) and the Alaskan coast (Craig and Haldorson 1981), Amphipoda and Mysidacea were found to be more important in the diet of Arctic cisco than they were along the Tuktoyaktuk Peninsula.

The diet of Arctic cisco from Richards Island differed from that of the Tuktoyaktuk Peninsula in that Copepoda did not occur in measurable quantities in any of the 16 stomachs analyzed. The major food items found were Mysidacea, Amphipoda, Ascidaceae, Pelecypoda and fish (32.5, 11.6, 11.2, 8.2 and 3.6% dry weight respectively). The food types which occurred in the greatest number of stomachs were Polychaeta, Amphipoda and Pelecypoda.

Polychaeta have not previously been reported as a common open-water-season food item for Arctic cisco. Under ice cover, however, a similar but more pronounced dependence of overwintering Arctic cisco upon Polychaeta in Tuktoyaktuk Harbour was reported by Bond (1982).

Observations by Stein et al. (1973b), Percy (1975) and Kendel et al. (1975) showed that the degree of feeding activity of Arctic cisco is largely dependent upon migratory and/or spawning activity and that generally less than 5% of migrating Arctic cisco had recently fed. Craig and Haldorson (1981) however reported as many as 45% of presumably non-migratory fish at Simpson Lagoon to be actively feeding.

Least cisco, Coregonus sardinella Valenciennes

The lake resident form and the anadromous form of least cisco: Two varieties of least cisco were identified during the course of this study. One which appears to be strictly a freshwater, lake spawning variety, was not caught at coastal sites. The other which is anadromous and has been described by a number of authors (Andriyashev 1954; McPhail and Lindsey 1970; Hatfield et al. 1972; Stein et al. 1973a; Percy 1975; Kendel et al. 1975) occurs along the coast in brackish water and is known to enter some small freshwater drainages (Chang-Kue, personal communication).

Numerous authors have reported these two varieties (Cohen 1954; Mann 1974; McCart et al. 1976). In some cases they were shown to occur sympatrically (Cohen 1954), in other cases this was not certain. The means of distinguishing the lake variety from the coastal anadromous variety appear to vary depending upon the population. Cohen (1954) reported the lake variety to grow faster and larger, with a more pronounced extension of the lower jaw. McPhail and Lindsay (1970) describe the non-migratory form as seldom exceeding 220 mm, the dorsal surfaces as never being spotted and the total gillraker count ranging from 41-47 (mean near 45). This they compared with the anadromous (migratory) form which reached a length of approximately 360 mm, usually had a heavily spotted dorsal surface and a first-arch total gillraker count of 48-53 (mean=50). Mann (1974) found that the freshwater resident achieved greater longevity (otolith aged) than the anadromous migratory form but did not grow as large (Fig. 60). Mann also found that "normal" (as opposed to dwarf) populations had significantly more pyloric caeca than did the anadromous variety.

We observed that, compared to the anadromous type, the lake dwelling least cisco from the Tuktoyaktuk Peninsula and Richards Island grew larger, were deeper bellied, more darkly pigmented both dorsally and in the ventral fins, and had a less protruding lower jaw. Another feature of the lake variety was that its scales were not so readily lost when the fish were removed from gillnets. Further comparative features follow.

LENGTH-WEIGHT RELATIONSHIP: Calculated weights of lake vs coastal least cisco are presented in Table 52. This table includes data from Mann (1974) for comparative purposes. In all cases, lake-dwelling least cisco were found to be heavier than their coastal counterparts of the same fork length.

NUMERICAL TAXONOMY: A number of least cisco of each form were arbitrarily selected for meristic study. A significant difference ($p<0.001$) was found to exist between the mean number of pyloric caecae of each form. Lake dwellers had a mean of 92.54 caecae (SD=13.84, n=11, range=66-108, median=98) and coastal cisco had a mean of 68.25 caecae (SD=8.0, n=16, range=56-81, median=67). A significant difference ($.01>p>.001$) was also found between the number of lateral line scales. Lake dwellers had a mean of 90.1 scales (SD=3.2, n=11, range=85-94) and coastal cisco had a mean of 82.1 scales (SD=6.7, n=15, range=70-92). Comparison with Mann (1974) revealed no significant difference ($p<0.05$) between his and our samples as regards the number of pyloric caecae found on coastal cisco. Similarly no significant difference ($p<0.05$) occurred between caecae counts of the two samples of lake-dwelling least cisco. However a noticeable difference was evident between the age-length relationship of lake-dwelling least cisco from Mann's study lakes and those from the lakes on Richards Island and Tuktoyaktuk Peninsula (Fig. 60). This may be due to differences in habitat rather than to differences in population genetics.

SPAWNING AND OVERWINTERING HABITS AND HABITAT: Lake-resident least cisco are known from previous investigations by the senior author to spawn and overwinter in Lake 2 of Loc. 1. Least cisco from this lake emigrate to suitable summer lake feeding habitat during spring breakup. While they do disperse to other lakes in the drainage system they do not appear to migrate to coastal sites.

Other lakes which may serve as spawning and overwintering habitat for lake resident least cisco are Lake 2 of Loc. 83, 63 and 62 (Fig. 1). Additional watersheds on Tuktoyaktuk Peninsula which support least cisco, and which have potential overwintering sites are at Loc. 22A and 23 (Fig. 1).

The lake-dwelling least cisco sexually ripened earlier than the anadromous least cisco; an observation also reported by Mann (1974).

Anadromous, migratory least cisco spawn in the Mackenzie River (Percy 1975; Stein et al. 1973b) and overwinter in Kugmallit Bay (Bond 1982).

Seasonal geographic distribution, abundance, sexual maturity:

JUNE/JULY - COASTAL HABITAT: Least cisco represented 21.6, 9.1 and 15.9% of the coastal spring catch of fish in 1978, 1979 and 1980 respectively (Table 9). Catches were highest along the southeast coast of Kugmallit Bay. The mean CUE of 1.4 fish (range 0.05-3.9) was the highest of the anadromous species (Table 21). The distribution of catches along the coast was limited for the most part to the inner estuary (Fig. 24). Salinity ranged from 1-31.

Juvenile least cisco were caught in seines at a number of locations along the Kugmallit Bay coast as well as at McKinley Bay (Loc. 31, 31A), the artificial island site (Loc. 77) and Mason Bay (Fig. 24). The mean fork length of juvenile least ciscoes was 76.7 mm (range=65-90 mm, SD=6.8 mm, n=18) in 1980, and 78.3 mm (range=58-104 mm, SD=11.7 mm, n=33) in 1978. By inference from fork length, these were all assumed to be 1+ years old. The spring 1979 sample ranged in fork length from 47-109 mm.

A small proportion of the least cisco gillnetted during the spring surveys were mature fish (Table 53). These were 6-9 year old females and were caught in close proximity to the East Channel of the Mackenzie River. Assuming that least cisco overwinter in the outer delta and Kugmallit Bay areas (Bond 1982; Percy 1975), and that spawners commence an upstream migration towards their spawning habitat in the spring, these sexually mature fish may represent the tail end of that migration.

STREAM HABITAT: A fish fence (25 mm mesh) was operated 03-10 July 1978 on the stream at Loc. 1. No least cisco were found moving downstream during this period. The upstream migrants (n=89) were all >200 mm long, with 276-300 mm being the dominant length class (Fig. 61). These cisco were not categorized as to lake or anadromous type. In 1979, two lake variety upstream migrants, aged 7 yrs and measuring 309 and 324 mm long, were caught in hoop nets set at this location. No downstream least cisco movement was recorded.

Both up and downstream least cisco migrations were recorded at Loc. 22A, 23 and 31 (Fig. 24) during the third week of July 1979. The upstream migrants were consistently smaller and younger (mean fork length=287 mm, range=233-344 mm, n=17; mean age=5.4 yr, range=4-7, n=14) than the downstream migrants (mean fork length=330 mm, range=245-377 mm, n=23; mean age=7.4 yr, range=3-10, n=18).

On Richards Island during the spring of 1980, only downstream least cisco migrants were caught (Table 24). The numbers and ages of least cisco varied. For example, at the Loc. 63 stream, a single adult lake variety was caught while at Loc. 62, 110 least cisco juveniles (fork length range=77-100 mm) were caught.

JUNE/JULY LAKE HABITAT: Least cisco accounted for 40.0% and 9.9% of the fish caught in lakes in the spring surveys of 1979 and 1980 respectively (Table 17).

Least cisco were caught in 61% of the lakes fished, with a mean CUE of 0.22 fish (Table 22). They were sexually immature or non spawners (Table 54).

In 1978, no spring gillnetting survey was performed at freshwater sites; however at the weir constructed at the outflow of Lake 2, Loc. 1, 31,000 least cisco of the lake variety were counted between 26 June and 01 July moving downstream from their overwintering habitat. Least cisco accounted for 91% of the total number of fish which emigrated from the lake.

Fifty-eight percent of those sampled on the first day of the downstream run were sexually mature, which may be indicative of a discrete spawning population, as this was not observed among least cisco from the coastal sampling.

AUGUST - COASTAL HABITAT: Least cisco represented 7.9, 6.4 and 13.7% of the mid-summer coastal catch for 1978, 1979 and 1980 respectively (Table 9). Catches were more frequent but occurred within the same geographic range as in the spring (Fig. 24). The mean CUE was similar to that of the spring, with catches being largest along the Kugmallit Bay coast.

Salinity ranged from <1-30 at locations where least cisco were caught.

Juvenile least cisco were caught in seines at more locations during the mid-summer survey than in the spring (Fig. 24). Young of the year least cisco, which were absent from the spring survey, were abundant at several locations during the mid-summer surveys of each year. They were predominantly caught at locations near the East Channel of the Mackenzie River.

The length-frequency distribution of least cisco caught in seines is shown in Fig. 62. In 1978, the mean fork length of young of the year ranged from 46.1-50.2 mm depending upon location

(total n=136). In 1979, young of the year caught at Loc. 1 and 4 ranged from 27-64 mm with a mean of 49 mm (n=42). The length-frequency distribution of the 1980 mid-summer seine catch was bimodal. Fry (0+) had a mean fork length of 52.7 mm, SD=8.2 mm, n=44, range=30-75 mm and represented 38% of the total seine catch.

AUGUST - STREAM HABITAT: Least cisco were caught in downstream hoopnets at Loc. 1, 4, 22a and 31 and included both adult and juvenile fish. The adult least cisco from Loc. 1 were the lake dwelling variety. Upstream least cisco which occurred at Loc. 1 and 22a were juveniles.

The Richards Island least cisco stream catch comprised only one fish (Table 24).

AUGUST - LAKE HABITAT: Least cisco were present in each watershed sampled in the midsummer surveys and accounted for 20.6, 18.2 and 25.1% of the fish caught in 1978, 1979 and 1980 respectively (Table 17). The mean CUE was higher than during the spring survey.

In 1979 and 1980 the proportion of mature least cisco was greater in the summer than in the spring (Table 54). The youngest mature fish were 5 years old, with the majority being 6-7 years. Least cisco caught in the midsummer survey of 1978 from Canyanek Lakes (Loc. 1) were mostly immature.

SEPTEMBER - COASTAL HABITAT: Least cisco represented 6.4, 31.7 and 8.1% of the coastal fall sample of 1978, 1979 and 1980 respectively. Although the size of catches was greater than during the spring and summer periods, the frequency of capture decreased (Fig. 24). Salinity ranged from <0.1-23 at locations where least cisco were caught.

Juvenile least cisco seined in the fall of 1980 included 0+, 1+ and 2+ year-old fish (by inference from the fork length distribution). The 0+ fish had a mean fork length of 59.6 mm (SD=10.2, range=45-78 mm, n=11). The 1+ fish had a mean fork length of 114.1 mm (SD=10.9, range=98-135 mm, n=11) and the 2+ fish ranged from 170-200 mm (n=5).

Eight, 22 and 12% respectively of the 1978, 1979 and 1980 fall coastal least cisco were mature (Table 53). Mature least cisco ranged from 5-8 years old and exceeded 266 mm in fork length. The majority of mature fish were caught near either the East Channel or Harry Channel (Loc. 78).

SEPTEMBER - STREAM HABITAT: No least cisco were caught in the Richards Island streams in the fall.

In streams along the Tuktoyaktuk Peninsula, the majority of least cisco were moving downstream (Table 24). The most numerous downstream migrants occurred at Loc. 1 and 4, a sample of which had a mean fork length of 106.6 mm (SD=6.4 mm, n=8, range=96-117 mm).

The downstream migrants at Loc. 22a and 31 had a mean fork length of 79.6 mm (SD=7.0, n=7, range=72-91 mm).

SEPTEMBER - LAKE HABITAT: Least cisco accounted for 30.8, 21.7 and 20.5% of the fall lake catch of 1978, 1979 and 1980 respectively. Both distribution and catch per unit of effort were similar to that of the midsummer samples.

Twenty-eight percent of least cisco taken in the 1980 fall survey were mature or ripe (Table 54). In the fall of 1979, 35% of the lake dwelling least cisco were ripe and 15% were spent males. All were taken from Lake 2 of Loc. 1 (Canyanek) and were 6 or 7 years old. In November 1980, the same lake was netted and all least cisco caught were spent males (n=10).

Length- and age-frequency distribution:

COASTAL HABITAT: Least cisco which were gillnetted from the coastal sites ranged in fork length from 94-362 mm (Table 55). The length-frequency distribution of least cisco is shown in Fig. 63. Males of the 1978 Tuktoyaktuk Peninsula coast sample were dominated by fish in the 251-275 mm length interval. Females were larger, being dominated by fish from 276-300 mm long.

A greater proportion of juvenile least cisco (101-125 mm) were caught at Richards Island coastal sites than along the Tuktoyaktuk Peninsula. These juveniles were 1+ year old (scale-aged), and most were caught along the west shore of Richards Island and at Pullen Island.

Kendel et al. (1975) and Percy (1975) also reported an abundance of juvenile least cisco in the Mackenzie estuary.

Least cisco caught along the Tuktoyaktuk Peninsula coast ranged in age from 1-8 years, with 5-6 year olds being the dominant age interval (Fig. 64). A greater proportion of both older and younger least cisco were caught along the Richards Island coast, with fish 6-7 years old dominating.

LAKE HABITAT: Lake-dwelling least cisco from 1978 and 1979, ranged from 132-428 mm fork length (Table 55) and had a length-frequency distribution distinct from the coastal form. In both years the length distribution was dominated by fish 301-325 mm long, and the majority of fish over 300 mm long were female (Fig. 63). The age of 1978 and 1979 lake-caught least cisco ranged from 2-9 and from 1-10 years respectively (Fig. 64). More than 50% of the fish gillnetted from the Canyanek system in 1978 were 6+ years old, whereas the 1979 modal age was 7 years even though the length-frequency distribution was similar to that of 1978. A higher proportion of slower-growing male least cisco in the 301-325 length interval (Fig. 63) in 1979 than in 1978 accounted for the greater modal age for the same length class.

On Richards Island the range in age (1-11 years) and fork length (94-362 mm) for least cisco gillnetted in 1980 was similar to that found in the lakes on Tuktoyaktuk Peninsula. However, the large catch on Richards Island of 1-year-olds (Lake 2, Loc. 62), dominated the

overall age- and length-frequency statistics (Fig. 63 and 64).

Age-length relationship: The age-length relationships of least cisco from the study are given in Table 56 and Fig. 65. In general lake-caught least cisco attained a greater fork length at a given age than those caught in coastal waters. For the 1978 and 1980 samples, differences were significant ($p \leq 0.05$; Table 57).

Percy (1975) described an age-length relationship of least cisco similar to that reported here.

Food habits - coastal fish: Results of stomach analyses of least cisco from coastal locations around Richards Island, western Tuktoyaktuk Peninsula and eastern Tuktoyaktuk Peninsula are displayed in Fig. 66 and Table 58. Sixty-nine percent of the stomachs examined from the Richards Island coast (n=75), 57% from western Tuktoyaktuk Peninsula (n=109) and 32% from eastern Tuktoyaktuk Peninsula (n=19), were empty.

Least cisco from the Richards Island coast were found to contain on the average only 0.01 g dry weight per stomach. Copepoda, Amphipoda and in some instances, Polychaeta were the major organisms in the diet, accounting for 35.7, 7.1 and 7.1% by weight respectively of the stomach contents. Fifty-seven percent of the stomachs analyzed contained Copepoda; 21% contained Amphipoda.

Least cisco from the western Tuktoyaktuk Peninsula coast (Kugmallit Bay) had on the average 0.03 g dry weight per stomach. Their diet differed from the least cisco of the Richards Island coast in that Amphipoda, as opposed to Copepoda, was the predominant food organism (in both frequency and weight). Along with Amphipoda, Mysidacea and fish were the major constituents of the diet of these fish (Table 58).

Least cisco from the eastern Tuktoyaktuk Peninsula coast had, on the average, 0.01 g dry weight of food per stomach. The order of importance of food items was similar to that from the Richards Island coast. Copepoda (22.2%), unidentified insect larvae (22.2%), Amphipoda (11%) and Mysidacea (11%) predominated in terms of dry weight and were also found in the greatest number of stomachs.

Percy (1975) reported 86% of least cisco from coastal sites of the outer Mackenzie Delta had empty stomachs and that the dominant food organisms were Amphipoda and unidentified insects. Kendel et al. (1975) reported a similar least cisco diet along the Yukon coast, with either Amphipoda or Copepoda being the dominant food, followed by Mysidacea and Isopoda, with 79% being empty. Craig and Haldorson (1981) at Simpson Lagoon on the Alaskan coast, reported a least cisco diet of crustaceans, with Mysidacea accounting for 66-69% of the wet weight composition, followed by Amphipoda and Copepoda.

In summary, least cisco in brackish waters feed primarily upon crustaceans and will occasionally feed upon fish, insects and benthic fauna. Feeding activity seems to depend upon migratory habits, with little feeding during migrations. There is some evidence from our work that in more turbid waters (Kugmallit Bay coast) larger prey (Amphipoda, fish) may be selected over smaller crustaceans. This observation however may be the result of seasonal and/or local fluctuations in food abundance, rather than predator selectivity.

Food habits - freshwater lakes: Results of the stomach content analyses of least cisco from the lakes of Richards Island, west Tuktoyaktuk Peninsula and eastern Tuktoyaktuk Peninsula are shown in Fig. 66 and Table 59.

Compared with the least cisco caught in coastal waters, fewer lake-residing least ciscoes had empty stomachs (35, 12 and 75% from Richards Island, western Tuktoyaktuk Peninsula and eastern Tuktoyaktuk Peninsula areas respectively). Stomachs contained 10 to 50 times more food, and the diet was more diverse than observed in coastal habitat.

Gastropoda, Trichoptera, fish, Pelecypoda, Hemiptera and Chironomida were dominant in the stomachs of least cisco from Richards Island (14.6, 13.2, 11.2, 8.8, 5.8 and 5.1% respectively). Organisms which occurred in the greatest percentage of stomachs were Chironomida, Gastropoda, Ostracoda, Trichoptera and fish (78, 43, 35, 30 and 26% respectively). All identifiable fish found in the least cisco were ninespine sticklebacks.

Least cisco from lakes of west Tuktoyaktuk Peninsula contained more food than in other areas studied. The predominant food organisms of these fish were Amphipoda, Gastropoda, Pelecypoda, Conchostraca and fish (34.2, 12.1, 9.3, 7.9 and 3.8% by weight respectively). The food organisms which occurred in the greatest percentage of stomachs were Amphipoda, Chironomida, plant matter, Gastropoda and Pelecypoda (60, 59, 48, 39 and 38% respectively). As with the Richards Island least cisco, the identifiable fish in the stomachs of these cisco were ninespine sticklebacks.

The diet of least cisco from the lakes of eastern Tuktoyaktuk Peninsula was distinct in that Cladocera and Notostraca were of major importance to their food habits. Cladocera, fish, Notostraca, Copepoda and Cumacea (47.8, 18.5, 14.5, 6.9 and 5.6% by weight respectively) composed the bulk of food organisms in the stomachs analyzed. Cladocera, Chironomida, Notostraca, Trichoptera and Copepoda occurred in the greatest proportion of stomachs (58, 50, 46, 33 and 29% of stomachs respectively). Gastropoda and Pelecypoda, important food organisms of this species both at Richards Island and the lakes of western Tuktoyaktuk Peninsula, were all but absent from the diet of fish from eastern Tuktoyaktuk lakes.

The opportunistic feeding habit of least cisco reported by Mann (1974) and Bond (1982) is corroborated here. The food organisms which were found to dominate the diet of lake dwelling

least cisco of Richards Island were benthic infauna which comprised more than 50% of the identifiable stomach contents while least cisco from lakes of Tuktoyaktuk Peninsula were found to be feeding largely on water-column and epibenthic organisms.

Percy's (1975) description of lake dwelling least cisco feeding habits differs from our observations. He reported 84% of least cisco from lakes of the delta to have empty stomachs and the identifiable material in those stomachs with food (n=11) was Amphipoda, Mysidacea and fish remains. The lake habitat which Percy (1975) studied however, was quite unlike the lake habitat in our study. The delta lakes sampled by Percy were typically river channel lagoons. The least cisco caught in them were the anadromous migratory variety, whereas those from our study lakes were mostly the freshwater non-migratory variety. Mann (1974) described food habits of lake-resident least cisco similar to those reported here.

Rainbow smelt, Osmerus mordax (Mitchill)

Seasonal life history: Rainbow smelt were gillnetted in the Mackenzie estuary and in bays and inlets along the coast. While this species inhabits the Mackenzie River and a number of its tributaries (Percy 1975; Stein et al. 1973b) it was not found in any of the small streams or lakes in our study area. Most small streams in this area are frozen to the bottom until early to mid June, by which time the rainbow smelt has already spawned (Stein et al. 1973b).

JUNE/JULY: The spring catch of rainbow smelt was sparse. They were not caught in the spring survey of 1978 and represented only 0.6% of the catch in 1979 (Loc. 31, 20 July). In 1980, rainbow smelt represented 3.5% of the Richards Island spring coastal catch (Table 9, Fig. 25).

The Richards Island (1980) sample (n=10) ranged in fork length from 229-289 mm and most were immature (Table 60). Two juveniles (42 and 47 mm fork length) were seined at Pullen and Hooper islands (Fig. 25), which based on Percy's (1975) rainbow smelt age-length data were 1-year-old fish. One-year-old rainbow smelt seined on 20 July 1979 at McKinley Bay had a mean fork length of 56 mm. Similar growth rates for rainbow smelt have been reported from Simpson Lagoon, Alaska (Craig and Haldorson 1981).

AUGUST: The midsummer catch of rainbow smelt was greater than in the spring. Smelt represented 10.1, 1.6 and 12.8% of the total midsummer estuarine catch of 1978, 1979 and 1980 respectively (Table 9). During this period, rainbow smelt had the highest mean CUE (2.29 fish) of all the anadromous species (Table 21, Fig. 25) and were caught at 33% of the locations fished. Salinity ranged from 10-27 at the Richards Island locations where smelt were caught, and from 4-24 at locations along Tuktoyaktuk Peninsula. During summer, juvenile rainbow smelt were caught in seines at Richards Island and along the Tuktoyaktuk Peninsula as far east as McKinley Bay (Fig. 25).

Rainbow smelt gillnetted at Richards Island in midsummer 1980 ranged in fork length from 116-277 mm (Table 61) and had a bimodal length frequency distribution with modal length intervals of 126-150 mm and 226-250 mm (Fig. 67). Smaller rainbow smelt were mostly caught along the north shore of Pullen Island (Loc. 81) and larger ones along the northwest shore of Richards Island.

The majority of rainbow smelt caught along the Tuktoyaktuk Peninsula during midsummer 1978 were from 201-275 mm fork length. Less than 10% of the smelt caught were under 200 mm (Fig. 67). Sexually mature males outnumbered mature females by 10:1 (Table 60).

SEPTEMBER: Rainbow smelt accounted for 6.9, 1.0 and 10.2% of the total catch of coastal fish in 1978, 1979 and 1980 respectively. The CUE was similar to that of summer, and the frequency of occurrence was greater (Fig. 25). A large number were caught in Mallik Bay (Loc. 83), where they had previously been absent from catches.

Salinity where they were caught ranged from <0.1-30 at Richards Island and from 10-24 along the Kugmallit Coast.

Seining in the fall of 1978 produced rainbow smelt young-of-the-year at Loc. 1 (mean fork length=27.3 mm, range=19-36 mm, SD=3.7, n=17), Loc. 22 (mean fork length=27.3 mm, range=22-30 mm, SD=3.6 mm, n=4) and Loc. 30 (mean fork length=24.7 mm, range=20-29 mm, SD=2.4 mm, n=14). Percy (1975) reported young-of-the-year rainbow smelt from the outer Mackenzie Delta as having a mean fork length of 31 mm (range=24-42).

In the fall of 1979 approximately 200 rainbow smelt young-of-the-year were seined at Loc. 4. The young-of-the-year seined at Loc. 20 during the 1979 fall survey had a mean fork length of 31.0 mm (range=28-3 mm, n=4).

Even though a similar proportion of rainbow smelt were present in fall catches from both the Tuktoyaktuk Peninsula and Richards Island coast, 32% mature fish were identified at the former as opposed to 5% mature at the latter area (Table 60). Segregation based on spawning activity is suggested by this observation.

Spawning and overwintering: Rainbow smelt spawn in the Yenisei River of Siberia under spring ice (McPhail and Lindsey 1970). Percy (1975) reported taking a single ripe smelt in April 1974 while fishing through the ice on the Middle Channel. He also reported taking several in March of 1974 and 1975 in the East Channel. Chang-Kue (personal communication) found spent smelt in June of 1980 in the East Channel, presumably moving downstream to the Kugmallit Bay area. More recently he observed ripe smelt upstream of the Mackenzie Delta in March 1984. In 1980, we caught spent smelt at Pullen Island in early July. Because so few smelt were taken in any of the spring coastal surveys, it was postulated that large numbers of spawners which had migrated to spawning areas had not yet returned from upstream spawning habitat to the coast.

It is worth noting that smelt younger than 6 years have not been reported in the upper Delta during summer (Stein et al. 1973b). It may be that only the spawners of this species utilize the Delta habitat. Congregations of wintering smelt have been found in Delta channels in the fall (Chang-Kue, peronal communication).

Age-length relationship: A total of 46 rainbow smelt from the three years of study were aged by otoliths. The age-length data are presented in Fig. 68 and Table 62.

Food habits: Fifty-three percent of all rainbow smelt stomachs examined (n=110) were empty. Analysis of 28 stomachs containing food showed this species to be highly piscivorous throughout the study area. Fish were present in 64% of the stomachs analyzed and were responsible for 95% of the total dry weight consumed. Mysidacea and plant material occurred in lesser amounts (3.1% and 2.7% by weight respectively) and with less frequency (18% and 11% of stomachs respectively - Table 63, Fig. 69).

Galbraith and Fraser (1974), reported a similar diet for rainbow smelt caught along Tuktoyaktuk Peninsula, however others (Percy 1975; Kendel et al. 1975; Bond 1982) reported a higher proportion of empty stomachs, and a much higher proportion of crustaceans in the diet. Craig and Haldorson (1981) reported a high proportion of Mysidacea (39.1% by weight) in winter-feeding smelt from Simpson Lagoon.

Broad whitefish, Coregonus nasus (Pallas)

Seasonal geographic distribution and life history:

JUNE/JULY - COASTAL HABITAT: Broad whitefish, which represented 19.6, 1.1 and 2.5 % of the total spring catch for 1978, 1979 and 1980 respectively (Table 9) were restricted to the inner-estuary sample locations (Fig. 26). The larger catch of this species in 1978 may be a result of the earlier sampling which coincided with the spring coastal migration from overwintering locations to summer feeding habitat. CUE averaged 0.66 fish within a range of 0.1-1.9 fish (Table 21). The largest catches occurred along the southeast shore of Kugmallit Bay.

Broad whitefish caught in gillnets during June/July 1978 ranged in age from 2-11 years with 6 year old fish being the dominant age class (Table 64).

No mature broad whitefish were caught during any of the spring sampling conducted in coastal locations (Table 65). However Craig and Haldorson (1981) reported broad whitefish to reach sexual maturity between age 9 and 14 and Percy (1975) reported broad whitefish being sexually mature as early as age 4.

Few juvenile broad whitefish were caught in seines during the spring surveys and no young-of-the-year were identified.

JUNE/JULY - STREAM HABITAT: Both juvenile and adult broad whitefish were caught in streams as they moved from the coast into freshwater lakes soon after ice-out (Fig. 74, Table 24). The upstream migrants were immature except for one mature specimen at the Loc. 4 stream site (age 9 female, 430 mm fork length). In most locations few broad whitefish were observed moving downstream to the coast. However, in June 1978 a large downstream run of broad whitefish (n=3041) was sampled at the fish-weir downstream of the overwintering lake in the Canyanek drainage (Lake 2, Loc. 1). These fish had a modal length class of 376-400 mm (Fig. 74, Loc. CF 200). A similar downstream movement of broad whitefish from this lake was sampled and tagged in the spring of 1974. Tags were subsequently recovered from Whitefish Station East and in the Mackenzie River near Holmes Creek (Lawrence, unpubl. data). Broad whitefish moving upstream from the coast in the first week of July 1978 were smaller than their downstream counterparts, having a modal length of 201-225 mm (Fig. 74, Loc. CF 100).

JUNE/JULY - LAKE HABITAT: Broad whitefish were caught in 15 of 18 lakes fished in the spring surveys of 1979 and 1980. Catches were highest in lakes without apparent overwintering capacity. The mean CUE was 0.49 fish (Table 22). They represented 48.7% of the total freshwater gill net catch (Table 17). Whereas broad whitefish were found to be the most abundant species in the catches from lakes in our study area, Percy (1975) reported broad whitefish to represent only 7% of his total lake catch. However, as stated previously, the lakes netted by Percy were physiographically and limnologically different from ours and in most cases might better be described as channel backwaters, lagoons or remnant channels.

The sexually mature broad whitefish caught during the spring surveys of 1979 and 1980 (Table 65) ranged in age from 9-13 years and 424-554 mm fork length.

AUGUST - COASTAL HABITAT: The distribution of broad whitefish, which represented 2.1, 3.6, and 6.8 % of the 1978, 1979 and 1980 coastal midsummer catches respectively, was similar to that found during the spring survey (Fig. 26). The most easterly record of this species was at Mckinley Bay where the salinity was 25. Overall, the broad whitefish midsummer-CUE was 0.71 fish (Table 21).

Few sexually mature broad whitefish were caught during midsummer (Table 65).

Juvenile broad whitefish were caught in seines primarily at Kugmallit Bay locations (Fig. 26). Broad whitefish from the 1978 seining had a mean fork length of 64 mm (n=6, SD=10 mm, range=51-73 mm). In 1979, they had a mean fork length of 49 mm (n=19, range=33-63 mm); and in 1980 a mean fork length of 57 mm (n=12, SD=7, range=48-72 mm) was recorded.

AUGUST - STREAM HABITAT: A large increase in the upstream movement of juvenile fish was observed in the August 1979 survey as compared to the spring survey. In particular, overnight hoopnet catches of 6 000 and 12 000 fish were made in streams at Loc. 23 and 31 (Fig. 75). The timing of this upstream movement coincided

with similar broad whitefish upstream migrations recorded in the Kukjuktuk Creek (Chang-Kue, personal communication).

At Loc. 1, coincident with the movement of juvenile fish upstream,numerous large, immature broad whitefish were moving downstream (Fig. 75).

No similar sized upstream movements of juvenile broad whitefish were observed at Richards Island locations in August of 1980.

AUGUST - LAKE HABITAT: Broad whitefish dominated the midsummer lake catches (Table 17). They occurred in 19 of the 23 locations fished with a mean CUE of 0.51 fish. Larger catches were from the shallower lakes.

The dominant fork length class (401-425 mm) of the midsummer lake-catch was similar to that of the spring, except that a greater proportion of juveniles (mean fork length <225 mm) were captured in midsummer 1979 than during either 1978 or 1980 (Fig. 73).

Two mature fish (11 and 16 years old) were caught in lakes during the August surveys.

SEPTEMBER - COASTAL HABITAT: Broad whitefish represented 1.7, 6.3 and 3.7 % of the coastal catch in 1978, 1979 and 1980 respectively (Table 9). The mean CUE was 0.65 fish (Table 21). Fall distribution, (Fig. 26), was more restricted than in the two previous surveys.

None of the fall-caught coastal broad whitefish were sexually mature.

Broad whitefish juveniles were caught at four locations (Fig. 26). Eleven young-of-the-year broad whitefish (mean fork length=64 mm, range=44-78 mm) were identified from 1978 seine hauls and similar results were obtained in 1979.

SEPTEMBER - STREAM HABITAT: In most cases, the September downstream run of broad whitefish surpassed the upstream migration (Table 23, Fig. 76), however no large runs were recorded. Both juvenile and adult fish were captured in the hoopnets at this time.

SEPTEMBER - LAKE HABITAT: Fall lake catches were dominated by broad whitefish (Table 17). Their distribution was widespread and CUE was slightly greater than in previous surveys. A notable proportion of small, young fish were present in the 1979 and 1980 fall catches (Fig. 70, 73) but these were absent from the Canyanek lakes sampled in the fall 1978 (Table 66).

One sexually mature fish (12 years old) was caught during the fall lake surveys.

Spawning and overwintering habitat: Characteristics of the Mackenzie River upstream spawning migration have been described by Stein et al. (1973b), Jessop et al. (1974) and most recently by Chang-Kue and Jessop (1983). From current research it would appear that broad whitefish spawn primarily in the mainstem of the Mackenzie River. There was little evidence to suggest that broad whitefish spawn in any of the freshwater systems of our study area. While young-of-the-year and 1-year-old fish were frequently caught at coastal locations and in abundance moving upstream in small streams, no young-of-the-year were captured moving downstream from freshwater lakes (Fig. 74, 75, 76).

Non-spawning broad whitefish are known to overwinter in a number of lakes along the Tuktoyaktuk Peninsula (Canyanek System and Kukjuktuk System). Other lakes which afford access to and from coastal areas and are deeper than 3 m may also provide overwinter refuge. The majority of the spawning population of broad whitefish probably overwinters in the Mackenzie River or Delta as evidenced by the work of Chang-Kue and Jessop (1983).

Length- and age-frequency distribution: The length-frequency distribution of broad whitefish from the Tuktoyaktuk Peninsula coast in 1978 was dominated by fish in the 351-375 mm fork length interval (Fig. 72). By comparison, broad whitefish from lakes of the study area were generally dominated by fish from 376-450 mm, depending upon season and area (Fig. 73).

Age-frequency distributions of broad whitefish from lakes (Fig 71 a,b,c) when compared to those from the coastal waters (Fig. 71 d,e,f) show a high proportion of 1-year-olds present in the lake catches of 1979. The presence of these 1-year-olds correlates well with the August observations of juvenile broad whitefish migrations upstream from the coast.

Age-length relationship: Age-length data for broad whitefish from lakes and coastal areas are presented in Table 67 and Fig. 77.

In general, broad whitefish grew most rapidly up to age 8-10 and few fish exceeded 500 mm. Overall, they ranged in age from 0+-16 years and in fork length from 89-538 mm.

Broad whitefish from the Canyanek system (1978) were significantly larger ($p<.05$) at ages 2, 3, 7, 8 and 9 years than were coastal broad whitefish sample of that year (Table 68). This may be an indication that the broad whitefish from this freshwater drainage are a distinct stock possessing distinct individual population growth characteristics. However it is as likely that differences are a result of the more productive freshwater habitat combined with the probability that the sample includes a majority of fish that are of pre-spawning age or are between spawnings of an undetermined annual frequency. Thus a minimal amount of energy would be expended upon spawn production and extensive spawning migrations and a maximum amount would go towards growth.

Food habits - freshwater lakes: Stomach content analyses of broad whitefish from lakes of the study area are shown in Fig. 78 and Table 69.

Sixteen and 25% of stomachs from the deep and shallow lakes respectively of Richards Island were empty and similar feeding habits were found for both lake types with Gastropoda,

Pelecypoda and Chironomida being the major food items. The average dry weight content of shallow-lake feeders was 1.43 g per stomach, whereas that of deep-lake feeders was 3.63 g per stomach. This difference in stomach content biomass was most likely due to deep-lake fish being larger than their shallow-lake counterparts (mean fork length from shallow lakes = 379 mm; mean fork length from deep lakes = 479 mm).

Stomach contents of broad whitefish from two western Tuktoyaktuk Peninsula drainages (Loc. 1 lakes and Loc. 4 lakes) were similar. At each location only 3% of the stomachs were empty. Gastropoda, Pelecypoda, Amphipoda and either Chironomida or other unidentified insect larvae were major food items in both drainages. Of secondary importance were Conchostraca, Notostraca, Ostracoda and Trichoptera larvae. Difference in average stomach dry weight contents between the two drainages (Loc. 1 drainage = 1.84 g/stomach, Loc. 4 drainage = 0.88 g/stomach) may reflect differences in food availability between the two systems as the size of broad whitefish from the two locations was similar (mean fork length for Loc. 1 = 387 mm; for Loc. 4 = 391 mm).

All 45 fish sampled from lakes of eastern Tuktoyaktuk Peninsula had been feeding. The mean dry weight per stomach was low (0.37 gm) compared to the other freshwater locations, however the fish were small (mean fork length=247 mm). Notostraca accounted for the greatest amount by weight (30%) of the stomach contents from these lakes. Gastropoda, Pelecypoda, Chironomida and Ostracoda accounted for most of the remainder of identifiable food items (21, 8, 5 and 1% by weight respectively).

Few researchers have reported the food habits of broad whitefish from freshwater lakes. Percy (1975) examined stomach contents of six broad whitefish captured in channels of the outer Mackenzie Delta. Identifiable food consisted of Gastropoda, Trichoptera and plant remains. Hatfield et al. (1972) reported the majority of broad whitefish in the stomachs from Mackenzie River being empty. They found that Corixida, Gastropoda and Pelecypoda were the dominant food items in adult broad whitefish examined, while the two juvenile broad whitefish (41-43 mm) contained almost exclusively Chironomida larvae. Percy (1975) reported that while stream specimens of broad whitefish fry were feeding on Plecoptera, Crustacea and Oligochaeta, lake specimens were feeding on Mysidacea.

It is apparent from our study that numerous coastal lakes, often less than 2.5 m deep, are important feeding habitat for broad whitefish. While Alt and Kogl (1973) stated that broad whitefish fed mainly in the brackish water of the Colville Delta, they did not sample the stomachs of lake dwelling broad whitefish, if in fact broad whitefish enter the lakes of that area.

Food habits - coastal waters: Nineteen percent of broad whitefish stomachs from the Richards Island coast (n=26) and 26% from the Tuktoyaktuk Peninsula coast (n=50) were empty. Pelecypoda accounted for 18% and 11% of the dry weight contents from Richards Island and Tuktoyaktuk Peninsula respectively. Polychaeta occurred in 61% of the stomachs from Richards Island but were rarely found in Tuktoyaktuk Peninsula fish (Table 70, Fig. 78).

The mean dry weight of stomach contents was considerably less for coastal broad whitefish than for lake-dwellers. Fish from the Richards Island coast had an average of 0.46 g dry weight per stomach (mean fork length=378 mm) and those from Tuktoyaktuk Peninsula coast had an average of 0.41 g dry weight per stomach (mean fork length=334 mm).

Other investigations of the food habits of broad whitefish from coastal waters (Percy 1975; Kendel et al. 1975; Jones and Den Beste 1977; Bond 1982; Galbraith and Fraser 1974) have shown a diet similar to that reported here. However in general, a much higher incidence of empty stomachs had been reported previously along with food being present in smaller amounts. Bond (1982) for example reported that 88% of stomachs of broad whitefish caught in Tuktoyaktuk Harbour were empty.

Lake whitefish, Coregonus clupeaformis (Mitchill)

Seasonal geographic distribution and abundance:

JUNE/JULY - COASTAL HABITAT: Lake whitefish accounted for 12.1, 6.0 and 6.7 % of the spring coastal catches of 1978, 1979 and 1980 respectively (Table 9). Catch per unit effort ranged from 0.14-2.1 fish (mean CUE=0.61 fish, Table 21). Lake whitefish were for the most part restricted to the inner estuary Fig. 27) where salinity ranged from 0.2-5.5 along the Richards Island coast and from <0.1-2.5 along Tuktoyaktuk Peninsula.

Lake whitefish from the Richards Island coast in 1980 were bigger (mean fork length=323 mm) and older (mean age=10.1 years) than the lake whitefish from the Tuktoyaktuk Peninsula coast (1978 - mean fork length = 286 mm, mean age = 6.9 years; 1979 - mean fork length = 205 mm, mean age = 4.4 years, Table 71). These differences are probably due to between-year variation in the timing of movements of large and small fish, which resulted in different population segments being sampled each year. On the other hand, those lake whitefish caught along Richards island coast may have been a different stock, possessing a distinct population age-structure. With regards to the migratory characteristics of lake whitefish along Tuktoyaktuk Peninsula, Chang-Kue (personal communication) observed that large lake whitefish preceded the smaller ones in the spring upstream run into the Kukjuktuk system. It appears that this early migration of older fish along the Tuktoyaktuk coast to Kukjuktuk drainage (and other coastal drainages) preceded the coastal sampling in 1978 and 1979. Regardless of location, all lake whitefish sampled in the spring surveys were immature (Table 72).

Lake whitefish were caught in seines at several locations on the Kugmallit Bay coast

(Fig. 27). At Loc. 1, 2 and 3 in 1978 juveniles had a mean fork length of 84 mm (range=56-149 mm, SD=20.7, n=32).

JUNE/JULY - STREAM HABITAT: No lake whitefish were caught in hoopnets set in Richards Island streams. Minor stream migrations of lake whitefish were observed however at locations along the Tuktoyaktuk Peninsula (Table 24).

JUNE/JULY - LAKE HABITAT: The distribution and abundance of lake whitefish in the lakes of the Tuktoyaktuk Peninsula were sparse. Only three lake whitefish were caught (Table 22, Fig. 27). However, lake whitefish represented 5.9 % of the total spring catch from the lakes on Richards Island (Fig. 27). They occurred in six of eleven lakes sampled, with a CUE of 0.12 fish (Table 22).

AUGUST - COASTAL HABITAT: The midsummer coastal distribution of lake whitefish was similar to that of spring (Fig. 27) but mean CUE was greater at 0.82 fish (Table 22). Salinity ranged from 0.04-20 at the locations where lake whitefish were caught.

Lake whitefish from Richards Island coast were smaller than those caught in the spring. Mean fork length in August was 273.3 mm (n=13) and the mean age was 7.9 years. Likewise, lake whitefish from the Tuktoyaktuk Peninsula Coast in midsummer of 1978 and 1979 were slightly smaller than the spring specimens from that area (Table 71).

Juvenile lake whitefish, assessed as being young-of-the-year (mean fork length=46 mm, SD= 5.9 mm, range=37-57 mm, n=22) were caught at several Kugmallit Bay locations (Fig. 27). Six juveniles ranging in fork length from 61-102 mm (mean fork length=73 mm, SD=15.1) were also taken in seines. Young-of-the-year lake whitefish in the Athabasca River were found to range from 26-45 mm in the period from 30 May to 24 June (Tripp and McCart 1979).

AUGUST - STREAM HABITAT: Lake whitefish were moving downstream at three Richards Island locations and at Loc. 1 on the Tuktoyaktuk Peninsula. No fish moving upstream were caught. All the Richards Island fish were adults ranging in fork length from 335-480 mm. Two mature whitefish (age 14+ years) were from Loc. 63. The Loc. 1 downstream fish (n=16, fork length range=320-460 mm), one of which was sexually mature (438 mm, age 13+ years) were similar in size to their Richards Island counterparts.

AUGUST - LAKE HABITAT: No lake whitefish were caught in the Tuktoyaktuk Peninsula lakes during midsummer of 1979 and but for a single specimen were absent from the 1978 lake catch. In contrast, in midsummer 1980 lake whitefish were caught at nine of thirteen lakes sampled on Richards Island and accounted for 16.3% of the total lake catch (Table 17). The mean CUE (0.20 fish) was almost twice that of the spring. As well, nine whitefish were caught at Lake One, Loc. 1 which were similar in size and age (mean fork length=413, SD=44.9, range=300-418 mm, 6-17 years) to the downstream sample (described above) caught in this system. This suggests that the lake whitefish in this lake were in the midst of a downstream migration to the coast. Four of the nine fish were sexually mature the youngest of which was 8 years old.

SEPTEMBER - COASTAL HABITAT: Lake whitefish comprised 1.5, 22.8 and 2.1 % of the fall catch of 1978, 1979 and 1980 respectively (Table 9). Distribution and mean CUE were similar to the midsummer survey except that few lake whitefish were caught north of Tuktoyaktuk Harbour (Fig. 27). Salinity ranged from 0.06-30 along the Richards Island coast and from 2-17 along the Tuktoyaktuk Peninsula where lake whitefish were caught.

Few lake whitefish were caught in seines during the fall surveys. Juveniles (mean fork length=68 mm, range=53-85 mm, n=15) were caught at Loc. 4 in 1979. These were probably young-of-the-year based on a comparison with the size of scale-aged 1-year-old fish (Table 74).

SEPTEMBER - STREAM HABITAT: A single adult lake whitefish migrating downstream was caught in the hoopnets set during the fall survey.

SEPTEMBER - LAKE HABITAT: No lake whitefish were caught in the lakes sampled in the fall of 1978 or 1979. However in the fall of 1980, 9% of the fish caught in Richards Island lakes were lake whitefish. The fall distribution of lake whitefish was not as widespread as during the midsummer (Fig. 27) nor was the CUE as high (Table 22). The majority of lake whitefish were >400 mm long, of which 50% were mature.

Overwintering and spawning habitat: The majority of lake whitefish which are found in the Mackenzie River estuary probably overwinter in the Delta or the freshwater inner estuary (e.g. south Kugmallit Bay). Percy (1975) observed overwintering lake whitefish in several Delta channels as well as in Kugmallit Bay. Lake whitefish have also been caught during March in Tuktoyaktuk Harbour (Bond 1982). Also, some lakes of the study area most likely serve as overwintering habitat for lake whitefish (Table 12). Our data suggests that certain lakes on Richards Island, (Lake 2, Loc. 83 and Lake 2, Loc. 56) have year-round resident lake whitefish. This postulation is based upon the presence in these lakes of sexually mature lake whitefish, as well as on the potential of these lakes to provide ample overwintering habitat as evidenced by their depth. The differences in the age- and length-frequency distribution (Fig. 79, 80, 81, 82) and the age-length relationship (Fig. 83) between Richards Island lake-caught lake whitefish and coastal samples, support our hypothesis that lake-resident populations exist on Richards Island separate from the anadromous Mackenzie River population(s).

Sexually mature lake whitefish have been observed by Percy (1975), Stein et al. (1973b), Hatfield et al. (1972), Chang-Kue (personal communication) in the Delta. As we made no similar observations during this study, it is probable that a given year's spawning lake whitefish had

moved to the upper Delta prior to our spring coastal surveys.

Length- and age frequency distribution:

LAKE HABITAT: Lake whitefish caught in lakes on Richards Island (1980) were larger and older than those from the Mackenzie estuary. Lake dwellers ranged in fork length from 197-527 mm, with fish 426-450 mm dominating the length distribution (Fig. 79). There was little seasonal difference in the size distribution of the lake whitefish samples. Mean fork lengths were: 414 mm (SD=48.4, n=12) for the spring survey; 422 mm (SD=56.0, n=34) for the midsummer survey, and 421 mm (SD=79.1, n=18) for the fall survey. Lake whitefish from Richards Island lakes ranged from 4-17 years with 12- and 13-year olds dominating (Fig. 80).

COASTAL HABITAT: Coastal lake whitefish were smaller than those caught in the lakes. Whereas 77.5% of the 1980 lake sample was greater than 400 mm long, only 12% of the 1980 coastal sample was longer than 400 mm (Fig. 81).

The dominant age class for coastal lake whitefish from 1978, 1979 and 1980 was 7, 3 and 8 years respectively (Fig. 82).

Age-length relationship: Growth of the lake whitefish in the Mackenzie estuary is slow, especially after age 9-10, and is highly variable (Fig. 83, Table 73). For example 8-year-old specimens from 1978 ranged in fork length from 254-428 mm, and 11-year-olds ranged from 346-434 mm. Small sample sizes did not permit analysis of the variety of factors (multiple stocks, protracted sampling period, sex and sexual development) which may have contributed to the variable growth rate.

In Alaskan Arctic rivers (Colville and Kobuk rivers) whitefish of the Coregonus clupeaformis complex also grow slowly, averaging 267 mm fork length at 5+ and 405 mm at 10+ (Morrow 1980). As well, growth rates vary greatly from place to place and even in different sections of the same river (Nikolskii 1961 in Morrow 1980). Comparison between Richards Island lake dwelling lake whitefish (1980) and lake whitefish from the coast (1978) revealed the lake-dwellers were significantly larger between ages 8 and 12 (Table 74).

Food habits - freshwater lakes: Stomach content analyses of lake whitefish from lakes on Richards Island and Tuktoyaktuk Peninsula are presented in Fig. 84 and Table 75. Twenty-three percent of the stomachs from Richards Island lakes (n=48) were empty but none from Tuktoyaktuk Peninsula were (n=4).

Gastropoda, Amphipoda, Pelecypoda, Chironomida accounted for 66, 4, 1.4, and 1.1% of the total dry weight respectively of stomach contents of lake whitefish from Richards Island. Food items most often found in stomachs were Gastropoda, plant material, Pelecypoda, Nematoda and Chironomida. Mean dry weight per stomach was 1.55 g. The importance of molluscs to the diet of lake whitefish from Richards Island lakes was similar to that reported by others (Hatfield et al. 1972; Percy 1975).

Notostraca comprised 25% of the diet of lake whitefish from lakes of eastern Tuktoyaktuk Peninsula. Amphipoda, Gastropoda, and Pelecypoda were also important food items, representing 24, 19 and 7% of the dry weight respectively.

Food habits - coastal fish: Lake whitefish diet as revealed by stomach content analysis varied depending upon at which of three coastal they were caught (Fig. 84 and Table 76). Thirty-five percent of the stomachs examined from the Richards Island coast (n=20), 50% from southern Kugmallit Bay (Loc. 1-5, n=60), and 15% from the northern Kugmallit Bay (Loc. 10-22, n=13), were empty.

The mean dry weight of the stomach contents from the Richards Island coast was 0.79 g per fish. Oligochaeta and Pelecypoda accounted for 23.7 and 11.9% respectively of the dry weight with Amphipoda, Pelecypoda and plant matter being the most commonly occurring food items. Mysidacea and Isopoda accounted for only 3% by weight of the stomach contents.

Benthic infaunal organisms did not contribute significantly to the diet of coastal lake whitefish from the southern Kugmallit Bay (Loc. 1-5). Isopods, plant material, Amphipoda and fish contributed respectively, 75, 7, 2 and 4% of the total stomach dry weight contents of these fish. Isopoda, plant matter, Amphipoda and Mysidacea were common in most stomachs. Lack of suitable habitat for benthic infauna is probably the cause for their scarcity in the diet of lake whitefish from this area. Stomach contents averaged 0.61 g dry weight.

Along the Kugmallit Bay coast north of Tuktoyaktuk Harbour (Loc. 10-22), only Pelecypoda and plant matter were common food items. While the lake whitefish examined from this region were, on average, the largest, their stomach contents weighed the least (average dry weight per stomach = 0.24 g).

A greater proportion (69%) of the lake whitefish stomachs from the Yukon Coast examined by Kendel et al. (1975) were found to be empty than were reported in this study (42% empty overall). Kendel et al. (1975) reported that lake whitefish from the Yukon coast fed primarily on insect larvae and Amphipoda whereas from the Richards Island and Tuktoyaktuk Peninsula coasts they fed heavily on Pelecypoda and Isopoda.

Percy (1975), in his study of coastal lake whitefish diet, reported 76% of stomachs empty. Isopoda, Pelecypoda, Chironomida and Amphipoda were the major food items. Jones and Den Beste (1977) examined 14 lake whitefish stomachs fom coastal locations in the Loc. 10-22 region of our study and found that Pelecypoda were the only identifiable organisms present.

Inconnu, Stenodus leucichthys (Guldenstadt)

Seasonal geographic distribution, abundance and sexual maturity: Inconnu were not caught in the lakes and small streams of the study area but only in the coastal, estuarine habitat.

Percy (1975) reported large catches of inconnu in both the channels of the lower Mackenzie Delta and the 'turbid lakes' connected to them. Few inconnu have been reported to occur west of Shingle Point (Percy 1975; Kendel et al. 1975).

JUNE/JULY: Inconnu accounted for 5.9, 1.1 and 10.2% of the spring coastal catch of 1978, 1979 and 1980 respectively (Table 9). Catch per unit effort was low compared to other anadromous species, (mean CUE=0.6 fish, Table 21) with inconnu most frequently caught along the north and west shores of Richards Island and along the south shore of Kugmallit Bay (Fig. 28). Small catches were occasionally made along the east shore of Kugmallit Bay as far north as Loc. 20 (Fig. 1). A single inconnu was recorded at Loc. 32, a lagoon along the north east shore of McKinley Bay.

Salinity ranged from 0.24-31 at the Richards Island locations where inconnu were caught and from <0.1-10.6 along the Tuktoyaktuk Peninsula.

No juveniles were caught by seining during any of the spring surveys and no sexually mature inconnu were caught (Table 77).

AUGUST: Inconnu accounted for 1.7, 3.6 and 11.1% of the total August catches of 1978, 1979 and 1980 respectively (Table 9). The mean CUE was higher than in the spring (Table 21) and distribution was restricted to southern Kugmallit Bay (Fig. 28).

Salinity ranged from <0.1-20 at the Richards Island locations where inconnu were caught.

As was the case with the spring survey, no mature inconnu were caught during midsummer (Table 77). Seining efforts yielded juvenile inconnu at Loc. 56 and 57, near the mouth of the east channel. They measured 64 and 146 mm fork length corresponding to 0+ and 1+ respectively (Alt 1969).

SEPTEMBER: Inconnu represented 3.4, 11.4 and 4.3% of the fall coastal catch of 1978, 1979 and 1980 respectively (Table 9). Catches were slightly larger than during midsummer and were, with one exception, restricted to the inner estuary (Fig. 28, Table 21). Salinity ranged from <0.1-30 at Richards Island catch sites, and from 2-18 along the Tuktoyaktuk Peninsula coast.

A 2-year-old (scale aged) inconnu, 173 mm long, was seined at Loc. 56, near the mouth of the east channel. A juvenile was also seined at Loc. 1 in the fall of 1978. All inconnu from the fall were immature.

Spawning and overwintering: Inconnu in Arctic drainages of Alaska commence upstream migration from brackish overwintering areas at spring break-up. The early upstream movement is associated with feeding but later becomes a definite migration to spawning areas. Following spawning at water tempreratures of 1.5-4.6°C in late September a fairly rapid descent to overwintering areas takes place (Morrow 1980). Alt (1969) suggested that it was unlikely that inconnu spawn every year and that non-spawners do not migrate very far upstream.

Dymond (1943) provides accounts of mostly young inconnu being caught in the shallows of Kugmallit Bay in September. This is in accordance with more recent findings in the Mackenzie Delta area which documented a peak upstream movement in July of predominantly 720-810 m inconnu (age 11-14+) in the vicinity of Arctic Red River (Hatfield et al. 1972). Percy (1975) monitored seasonal changes in the abundance of inconnu in outer Delta channels and reported numbers declined by the end of July at East Channel and Harry Channel locations, but that these were non-spawning fish. Similar to Percy's (1975) findings, abundant catches were made in 1978 and 1980 of inconnu (165-456 mm fork length) of which none were that year's spawners. It seems that spawning fish had migrated upstream prior to the commencement of the June/July surveys. However, in 1979 three mature and two spent male inconnu were caught at Loc. 4 on 16 September. They ranged in age from 6-11 years. The presence of the two spent inconnu is unusual as spawners would be expected to be upstream of the Mackenzie Delta at fall spawning locations by this time (Stein et al. 1973b).

Inconnu overwinter in deep embayments of the Mackenzie estuary, such as Mallik Bay (Percy 1975) and Tuktoyaktuk Harbour as well as in Kugmallit Bay where they have been caught in March and April (Bond 1982).

Length- and age-frequency distribution: Inconnu caught in gillnets set at Tuktoyaktuk Peninsula locations in both 1978 and 1979 were of a similar size range (228-791 mm fork length) and age distribution (Table 78). In both years, inconnu in the 401-450 mm length interval were dominant (Fig. 85), and 6 years was the dominant age (Fig. 86).

In 1980 inconnu from coastal locations along Richards Island ranged in age from 2-17 years and in fork length from 165-956 mm (Table 78). Eight-year-old fish were dominant (Fig. 86). Percy (1975) reported a bimodal length distribution of inconnu from the outer Mackenzie Delta with inconnu 551-600 mm and 251-300 mm dominating. While inconnu less than 350 mm long were scarce in our coastal samples from 1978-1980, they were caught by Percy in the Delta and in Mallik Bay in late June.

Age-length relationship: Inconnu from Richards Island grew rapidly during the first five years with age 5 inconnu attaining a mean fork length of 455 mm. By age 10 inconnu were 604 mm long, and by age 15 they measured 748 mm (Table 79, Fig. 87). Percy (1975) reported a similar age-length relationship for inconnu captured in the outer Mackenzie Delta. Hatfield et al. (1972) likewise reported a similar growth rate for inconnu up to 9 years from Arctic Red River. However, older fish grew more rapidly than did the inconnu from Richards Island. Growth of inconnu from the Tuktoyaktuk Peninsula coast was slower than that of their Richards Island counterparts (Fig. 87, Table 78).

Food habits: Inconnu were the most highly piscivorous coastal fish examined with 93.5% of the total dry weight of the stomach contents being fish. Identifiable species included pacific herring, cod, ninespine sticklebacks and lamprey ammocoetes. Smaller amounts of Isopoda, Mysidacea, Nematoda, Amphipoda and Pelecypoda were also found in some stomachs (Fig. 88, Table 80). The mean dry weight of stomach contents was 3.64 g with 15% of the 61 inconnu stomachs examined found empty.

Adult inconnu studied in Great Slave Lake (Fuller 1955) had a similar abundance of fish in their diet. Ninety-five percent of inconnu which were feeding contained fish. Only 2% of specimens had fed upon invertebrates. Tuktoyaktuk Peninsula coastal inconnu contained 3% by weight invertebrates, of which Mysidacea occurred most frequently.

Percy (1975), Kendel et al. (1975), and Jones and Den Beste (1977) reported that the diet of adult coastal inconnu consisted of 90% fish. They reported a higher incidence of empty stomachs however, (75%, 60% and 50% respectively) than was observed in this study.

Lake trout, Salvelinus namaycush (Walbaum)

Life history:

COASTAL HABITAT: Lake trout seldom venture into the turbid, brackish water of the Mackenzie River estuary although there have been occasional reports of individual lake trout being caught in Tuktoyaktuk Harbour. Percy (1975) caught several lake trout in Mallik Bay (Loc. 83, Fig. 1), and at Rae Island 8 km from the mouth of Harry Channel. In the course of this study, a 5-year-old, 204 mm lake trout was caught in the brackish water (10.4) at Loc. 77 in August 1980.

FRESHWATER HABITAT: Nine of the 23 lakes sampled in 1979 and 1980 yielded lake trout (Fig. 89). Two of the deeper lakes of the Canyanek drainage basin (Loc. 1) which were netted in 1978 also had lake trout.

The mean CUE was 0.19, 0.25 and 0.17 fish per hour respectively for the spring, summer and fall surveys of 1979 and 1980 combined (Table 22). Lake trout were found in more Richards Island lakes than in those of Tuktoyaktuk Peninsula; probably due to the greater proportion of deeper lakes sampled on Richards Island.

No lake trout were caught in any of the streams sampled.

Lake trout accounted for 3.9 and 8.6 % of the freshwater lake catch of 1979 (Tuktoyaktuk Peninsula) and 1980 (Richards Island) respectively (Table 17). On Richards Island, lake trout were the most common piscivorous species, while on Tuktoyaktuk Peninsula they were second to northern pike.

Richards Island lake trout (n=53), ranged in fork length from 235-815 mm, with fish 501-550 mm being the dominant class for both sexes (Table 81, Fig. 90). A subsample of 26 trout were aged. They ranged from 4-33 years with 20-year-old fish being the most frequently-occurring age class (Table 81, Fig. 91). Lake trout from lakes of Tuktoyaktuk Peninsula ranged from 402-684 mm fork length, and from 6-28 years for the 1978 and 1979 samples combined (Table 81).

All of the lake trout from Tuktoyaktuk Peninsula were immature whereas, depending upon the survey, from 25-44% of lake trout from Richards Island were mature; the youngest of which was 13 years. However first age of maturity in other northern areas may be as early as 5 years or as late as 13, but is generally in the seventh year (Morrow 1980). McCart et al. (1972) found that the youngest males with maturing testes were age 11 and the youngest females with maturing eggs were age 13 and 14 (Campsite and Itkillik Lakes respectively; Alaskan watersheds).

On the basis of the proportion of spawners present, lake trout in our study area appear to reproduce no more frequently than in alternate years. The absence of observed spawning migrations in the streams examined, leads to the conclusion that lake trout spawn in the lakes in which they were caught. There is probably little movement of lake trout from one watershed to another; as few lake trout have been caught in the brackish estuary.

Age-length relationship: The age-length relationships of lake trout from Tuktoyaktuk Peninsula and Richards Island are presented in Table 82 and Fig. 92. These trout have considerable longevity and grow comparatively fast for this northern latitude. They were found to grow more rapidly than lake trout from the Alaskan North Slope (Itkillik and Campsite Lakes) as well as from lakes of the Murchison River basin (Lawrence and Davies 1978; Table 83). Lake trout from Great Bear Lake have an age-length relationship comparable to those from this study area (Falk et al. 1973).

FOOD HABITS: Lake trout were found to be opportunistic feeders, their diet varying depending upon the lake in which they were caught. While fish, unidentified Insecta and Chironomida larvae were important to the diet of lake trout from eastern Tuktoyaktuk Peninsula, those from western Tuktoyaktuk Peninsula (Loc. 1) fed mostly upon fish, Trichopterans and Gastropods.

On Richards Island diet varied depending upon the lake, however overall contents were dominated by Trichoptera larvae, then fish and Amphipoda. In total (Richards Island and Tuktoyaktuk Peninsula combined) 19% of 73 stomachs examined were empty (Fig. 93, Table 84).

Northern pike, Esox lucius Linnaeus

Life history: Northern pike were caught in 11 of the 23 lakes sampled in 1979 and 1980 and were found to be present in the majority of the Canyanek system (Loc. 1) lakes sampled in 1978 (Fig. 94). One northern pike was also caught in the slightly brackish coastal water at Loc. 56. Northern pike were seldom caught at locations where lake trout occurred and were found at only

two stream sites (Loc. 4 and 60; Table 24). The mean CUE was 0.23, 0.13 and 0.14 fish in the spring, summer and fall respectively of 1979 and 1980 combined (Table 22). Pike represented 5.1 and 7.8% of the freshwater catch in 1979 and 1980 (Table 17).

Northern pike 451-500 mm long were the dominant length class in the gillnet sample, which ranged from 195-654 mm in fork length (Fig. 95, Table 85). Age ranged from 1-15 years with 7-year-olds being the modal age class (Fig. 96).

Stein et al. (1973b) reported the minimum age at maturity for northern pike to be from 3-4 years in the Mackenzie River, depending upon location. Percy (1975) found that in the outer Delta, no fish younger than 7 years were mature. On Richards Island and Tuktoyaktuk Peninsula the majority of northern pike were either immature or in a maturing state. The youngest mature pike was 5 years of age.

The age-length relationship for the lake-dwelling northern pike of the Mackenzie Delta region is shown in Table 86 and Fig. 97. Growth was fairly rapid through to age 9 or 10, by which time the pike had reached a mean fork length of 570-600 mm. The 1980 and 1978 samples were scale-aged whereas in 1979 they were aged using otoliths. Generally, otolith-aged fish indicate slower growth. The growth in pike up to age 10 was found to be similar to that reported for pike from lakes of the Minto Flats area in the upper Yukon River drainage. However pike from that area were as old as 23+ and up to 1040 mm fork length (Alt 1969).

Fish (unidentified, stichaeidae and salmonidae) accounted for more than 90% by weight of the contents of pike stomachs (n=25). Notostraca, unidentified eggs and plant remains constituted most of the remaining 10%. Percy (1975) found that pike from the lower Mackenzie River, channel lakes and lagoons fed primarily on whitefish and cisco.

Burbot, Lota lota (Linnaeus)

Life history: Burbot distribution was similar to that of lake trout. They were most frequently caught in the deeper lakes of Richards Island and their coastal distribution was restricted to the fresher waters (Loc. 1 and 56, Fig. 98). Burbot were found in streams on both Richards Island and Tuktoyaktuk Peninsula. At Loc. 22A a downstream migration of juvenile burbot was observed in the fall of 1979. The water at the mouth of this stream had salinity of 5, well in excess of what burbot are generally known to tolerate (Percy 1975).

Burbot are commonly caught through the ice in the vicinity of Tuktoyaktuk and have been taken in open water in Tuktoyaktuk Harbour (Hunter 1975; Hopky and Ratynski 1983). It is not known whether they are year-round residents of Tuktoyaktuk Harbour, but it is suspected that they retreat to fresher water in the late summer as coastal waters of the area become more saline. This species does overwinter in Kugmallit Bay and at the shallow entrance to Tuktoyaktuk Harbour (Bond 1982), during which time the salinity in the upper 4 m of the water column becomes increasingly reduced.

Burbot caught in the lakes of the study area ranged in length from 447-740 mm and in age from 6-21 years (Table 87). Insufficient burbot were sampled to determine a satisfactory age-length relationship. The most rapid growth occurred up to age 9 by which time burbot were around 500 mm total length (Fig. 99). The few samples aged by Percy (1975) from the Mackenzie Delta indicated more rapid growth for burbot residing in the Delta (550 mm at age 7-8).

Burbot stomachs (n=13) showed a much broader spectrum of food items than might be expected for this normally pisciverous species. Notostraca, Amphipoda, Mollusca, fish eggs, Mysidacea and ninespine sticklebacks accounted for the majority of the stomach contents. Percy (1975) also reported that whereas fish were the main food item in burbot angled in the coastal waters, invertebrates (particularly Isopoda), replaced them in importance in the channels and lakes of the lower delta.

Ninespine stickleback, Pungitius pungitius (Linnaeus)

Life history: Ninespine stickleback are an important food to a number of species of fish in both coastal and freshwater regions. They were the principal prey of northern pike from Richards Island and western Tuktoyaktuk Peninsula lakes and were identified in the diet of least cisco, lake whitefish, lake trout and burbot (Table 11). At coastal sites, they were identified in the stomachs of inconnu and were probably not excluded from the diet of other coastal fish. Ninespine stickleback have also been found in the stomachs of least cisco in lakes of the Kukjuktuk Creek system (Fallis, personal communication).

With one exception, ninespine stickleback were caught only in seines and hoopnets. Their distribution along the coast is shown in Fig. 101. Salinity ranged up to 16.8 at coastal locations where they were caught. They were caught in all but one stream sampled and there was evidence of a major fall downstream run of this species. The largest downstream migrations were observed at streams at Loc. 1 and 31 in 1979, where catch rates of 780 fish/hour and 690 fish/hour respectively were calculated for the 24 h hoop net sets (Table 24). A similar downstream movement of ninespine sticklebacks was observed in the fall of 1979 in the freshwater drainage to Kukjuktuk Bay (Fallis, personal communication). The motive for this downstream run is not clear, but it has been postulated that coastal forms of the ninespine overwinter in estuarine waters (McPhail and Lindsey 1970). Ninespine stickleback are known by the authors to overwinter in numerous lakes of the Tuktoyaktuk Peninsula.

Fork lengths of ninespine sticklebacks sampled from seines and hoopnet catches ranged from 21-60 mm. Their length-frequency distribution (Fig. 100) was bimodal, with dominant length classes of 26-35 mm and 46-55 mm (n=70).

Pond smelt, Hypomesus olidus (Pallas)

Life history:

COASTAL HABITAT: Pond smelt were caught infrequently along the coastal Tuktoyaktuk Peninsula and Richards Island, with catches being exclusive to seine hauls (Fig. 102).

During 1979, along Tuktoyaktuk Peninsula, catches were made from Loc. 1 (Canyanek Inlet) to Kukjuktuk Bay. All catches occurred during the spring and summer surveys with the exception of one fish which was caught near Kukjuktuk Bay on 9 September.

In 1980, seining along the Richards Island coastline yielded pond smelt during the spring and summer surveys only. These occurred at Loc. 56, 57, 60 and 62 (Fig. 102). Salinities in which these fish were present ranged from .04 at Loc. 57 to 5.5 at Loc. 60, suggesting an anadromous form of this species in the southern Beaufort Region. Hamada (1961) has reported anadromous pond smelt which enter the Ishikari River from the sea of Japan. However most literature on pond smelt in the Canadian Arctic (McPhail and Lindsey 1970; Scott and Crossman 1973) has described this species as being strictly a freshwater dweller.

FRESHWATER HABITAT: Pond smelt were caught in five streams (n=276) and two lakes (n=2) during all surveys in 1979 and 1980 (Fig. 102, Table 17). Hoop net catches in the fall of 1979 at Loc. 4 yielded 224 downstream-migrating pond smelt. Chang-Kue (personal communication) reported downstream runs of up to several thousand per day in Kukjuktuk Creek during the same time period (September 1979). An emigration of young-of-the-year pond smelt from Lake 2, in the Canyanek (Loc. 1) drainage was sampled by the senior author in July 1974.

Pond smelt ranged in fork length from 24-96 mm and had a trimodal frequency distribution (Fig. 100).

No ages were determined for pond smelt in this study however McPhail and Lindsey (1970) reported 1- and 2-year old pond smelt averaging 60 mm and 80 mm respectively in Black Lake, Alaska.

Longnose sucker, Catastomus catastomus (Forster)

Life history: Longnose sucker were absent from lake and hoopnet catches, but were caught in gillnets and seines at three coastal locations (Loc. 1, 2 and 56) where salinity ranged from 0.02-1.66 (Fig. 103). Longnose suckers are known to enter brackish waters of the Mackenzie estuary (Hunter 1975). Percy (1975) indicates that longnose suckers did not range far offshore in the outer Mackenzie Delta.

Seining proved an effective method of catching juvenile longnose sucker up to 96 mm fork length. During the 1978 spring survey, longnose sucker ranged from 41-60 mm fork length at Loc. 1 (Canyanek Inlet). They ranged from 26-92 mm fork length at the same locatior during the 1979 midsummer survey. According to Harris (1962), seine hauls in Great Slave Lake produced young-of-the-year longnose suckers ranging from 33-66 mm in length.

Larger fish (from 110-476 mm) were caught in gillnets. In 1978 one longnose sucker (476 mm) was netted at Loc. 1, while in 1979 a single longnose sucker was again caught at this location during the fall survey and measured 391 mm. In 1980 only two longnose suckers were caught in gillnets; both during the summer survey at Loc. 56. They measured 110 and 440 mm in fork length, and were aged 1+ and 10+ respectively.

Harris (1962) indicates that spawning longnose suckers in the Hay River, N.W.T. ranged in age from 9-15 years for females and from 10-15 years for males. Longnose suckers are known to spawn in inlet streams, lake shallows and outlets (McPhail and Lindsey 1970). A gravel or rocky substrate is utilized (Hatfield et al. 1972). No spawning runs were observed in any of the streams of Tuktoyaktuk Peninsula or Richards Island, although young-of-the-year and spent fish were captured at the mouth of Canyanek Inlet (Loc. 1). As well, one spent male (age 10+) and two spent females (age 8+) were captured at Loc. 56 and Loc. 2 respectively.

Stomachs received cursory examination in the field and were found to contain benthic fauna. Longnose suckers are also known to surface feed on floating terrestrial insects (Morrow 1980).

Arctic grayling, Thymallus arcticus (Pallas)

Life history: Arctic grayling were caught in the Canyanek system (Loc. 1) on Tuktoyaktuk Peninsula and in the streams flowing to Loc. 56 and 60 on Richards Island (Fig. 104, Table 24). Seining at Loc. 1 (Canyanek Inlet) on 26 June 1978 yielded nine grayling ranging from 57-82 mm fork length (Fig. 100).

No ages were determined for grayling during our study. Morrow 1980 states that from Interior Alaska, grayling at age 1, 2, 3, 4 and 5 years average about 148, 192, 228, 265 and 304 mm respectively.

Spoonhead sculpin, Cottus ricei (Nelson)

Life history: A single spoonhead sculpin was collected in a seine haul at Loc. 56 (Fig. 105) during the 1980 spring survey. Total length was 83 mm. Percy (1975) found spoonhead sculpin only in turbid lakes and steams of the outer Mackenzie delta, with 67 specimens ranging from 21-70 mm in length and ranging from 0+ to 3 years in age. They were found to be feeding mainly on Chironomida, Ostracoda, Mysidacea and Plecopteras.

Trout-perch, Percopsis omiscomaycus (Walbaum)

Life history: Seining yielded two trout-perch at Loc. 56 during the 1980 spring survey (Fig. 105). These were 42 mm and 37 mm fork length. Trout-perch ranging from 33-50 mm fork length from the outer Mackenzie were aged at 1 year (Percy 1975). Trout perch are known to

feed on aquatic insects, molluscs and crustaceans (McPhail and Lindsey 1970; Percy 1975; Morrow 1980).

RECOMMENDATIONS

1. Because of the presence of a diverse assemblage of species and/or high abundance of certain species, as well as the presence of suspected or known spawning habitat, certain areas should receive protection from disturbance due to development. These areas are: Mallik Bay, the northeast shore of Richards Island (including Mason Bay), Canyanek Inlet, and Hutchison Bay. Alteration at Tuktoyaktuk Harbour and McKinley Bay should be carefully regulated to ensure that important fish habitat is not lost or further disrupted.

2. Fish life history information is incomplete for all coastal species within the southern Beaufort Sea. In particular, information essential to the management and protection of species of known ecological and resource harvest importance should be given priority.
   a) For the anadromous species, the following information gaps should receive priority attention:
      broad whitefish and lake whitefish - spawning locations, spawning frequency, stock identification, abundance, larval ecology and post emergent dispersal.
      Arctic cisco - spawning locations, spawning frequency, stock identification, nearshore distribution.
      least cisco - taxonomy, biochemical differentiation and biology of the two form present in the southern Beaufort Sea region including spawning frequency and habitat for freshwater and anadromous forms, and nearshore distribution of the anadromous form.
      inconnu - abundance, spawning locations and spawning frequency.
      rainbow smelt - spawning locations outside the Mackenzie River, post larval dispersal.
   b) For the marine species, research effort is recommended in the following areas:
      Arctic and starry flounder - winter distribution, spawning habitat, migratory behaviour, abundance, offshore distribution.
      Pacific herring - stock identification, population size, distribution of post-larval to 3-year-old fish, identification and description of specific spawning habitat
      saffron cod - offshore and winter distribution and feeding habits, spawning habitat, abundance.
      arctic cod - all aspects of life history in the southern Beaufort Sea are poorly documented.

3. The Mackenzie River estuary is a complex system subject to annual, seasonal and even daily fluctuations in freshwater dispersion and circulation, which in turn affect the quality, quantity and availability of important fish species habitat. The factors affecting estuarine variability and its effect on the quality of available fish habitat must be better understood if icthyoplankton distribution and estimates of abundance and production are to be accurate. An understanding of Mackenzie estuary ecology sufficient to enable reliable predictions of the effects of development on the renewable resources and to predict sustainable harvests of fish species, will require many years of research. Towards this achievement, study is needed on the physical processes influencing estuarine circulation. Efforts must also be made on an ongoing basis to compile and analyze fisheries and fisheries habitat data in a manner which will ensure usefulness to planners and developers.

4. The whitefish and the least cisco of the area depend upon many of the small freshwater lake systems along the Tuktyaktuk Peninsula especially for summer-feeding and to some extent for overwintering. Because of this, the small streams which provide access to these lakes require protection. Research is required on the factors affecting the timing and success of fish migrations within these small stream-lake systems.

5. Detailed limnological investigations, in conjunction with biological studies, are required to assess the importance of the many coastal freshwater drainages to fish production in the Delta area: more specifically:
   a) The importance of estuarine versus lake primary production to total fish production in the coastal region is unknown, and should be assessed. We have concluded that the contribution of the many small lakes on the Peninsula, to the food-chain is significant and has been largely overlooked in the past.
   b) Observations were made of considerable feeding activity of juvenile broad whitefish moving upstream from the coast to summer habitat. It is postulated that these streams provide more than access to-and-from coastal and lacustrine habitat, but contribute significantly to energy and nutritive requirements of juvenile fish especially. Studies of the food habits of the fish utilizing these numerous small streams are recommended.

6. Under-ice studies have been neglected, largely because of logistic difficulties imposed by cold and lack of light. Future field efforts should give greater priority to under-ice work if reliable data on the spawning locations and overwinter habits of the marine species are to be obtained.

7. Springtime, under-ice studies coincident with the Mackenzie River freshet, should be conducted. The broad objectives of these studies would be to:
   a) Describe the upstream movement of the overwintering, spawning segment of the anadromous coregonids.

b) Describe the downstream dispersal of the previous year's spawners which have overwintered in the lower delta and estuary.
c) Describe the downstream dispersal of coregonid fry.

8. A systematic monitoring of environmental parameters should begin immediately to ensure that an adequate baseline of information exists upon which to measure change that may result from development activities in the area. Parameters should be those that will permit awareness of changes in levels of contaminants as well as monitoring of the health and productivity of living resources.
   a) Factors which should be taken into account during nearshore monitoring site selection are:
      i) distance from Mackenzie River;
      ii) exposure to currents;
      iii) bathymetry and hydrographic features;
      iv) influence of wind speed and direction on water quality;
      v) presence and type of human activity;
      vi) season;
      vii) substrate.
   b) Offshore site selection should take into account:
      i) proximity to the Mackenzie River plume;
      ii) bathymetry and hydrographic features;
      iii) season;
      iv) substrate.

9. Tuktoyaktuk Harbour is recommended as a site well suited to the investigation of the effects of industrial development on Arctic marine and estuarine biota.

10. The importance of filter-feeding benthic organisms such a pelecypods and gastropods to the diet of many of the fishes of the area has been demonstrated in these investigations. Activities (such as dredging) which would cause the depletion of these food organisms should be strictly regulated to ensure minimal negative effects.

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Table 1. Water quality features and other environmental parameters recorded during the spring 1978 survey of the Tuktoyaktuk Peninsula coast. Locations are shown in Fig. 1.

Date	Location	Bottom Depth(m)	Wind Vel.(km/hr)	Water Temp °C	TSS (mg/L)	Susp N (µg/L)	Susp C (µg/L)
26 June 78	1		NE 20	2.7	16		
	2		NE 20	2.5	68	162	1335
	3		NE 20	1.9	58	151	1420
	4		NE 20	1.9	80	163	1250
	5		NE 20	2.2	57	152	1265
28 June 78	17		N 30	3.4			
	20		N 30	1.9	39	96	655
	21		N 30		24		
	25		N 30				
	26		N 30	4.0	8	104	755
	31		N 30	2.0	16	51	620
	31A		N 30	6.0	11	128	1035
29 June 78	8	2.0	S 25	5.2	30	114	1005
	10	2.0	S 25	1.9	36	112	885
	12		S 25		38	99	795
	13	1.0	S 25	3.3	10	49	400
	14	0.6	S 25	2.1	32	84	725

Table 2. Water quality features and other environmental parameters recorded during the midsummer 1978 survey of the Tuktoyaktuk Peninsula coast. Locations are shown in Fig. 1.

Date	Location	Bottom Depth (m)	TSS (mg/L)	Susp N (µg/L)	Susp C (µg/L)
30 July 78	20	2.5	19	31	285
	21	1.5	21	57	430
	22	1.5	11	38	225
	23	3.0	15	33	455
	24	1.0	18	54	455
	25	1.4	16	44	254
	26	1.5	19	52	435
	27	1.5	19	78	445
02 Aug. 78	8	3.0	14	51	475
	9	1.0	67	197	2340
	10	2.0	19	57	525
	12	2.0	12	36	280
	13	3.0	13	36	295
	14	2.0	17	48	430
	15	2.0	16	41	340
	16	2.0	13	42	255
03 Aug. 78	28	1.5	19	71	520
	29	1.0	15	51	425
	30	1.0	18	37	305
	31	1.5	16	51	470
	31A	2.0	21	83	680
	32	2.0	19	45	460
	33	1.0	22	36	360
	34	4.0	12	49	365
05 Aug. 78	35	2.5	16	25	255
	37	1.0	17	42	315
	38	1.5	17	29	235
	40	6.0	15	34	265
	41	1.5	15	20	170
	43	2.0	17	42	255
	45	3.0	11	34	280
	46	6.0	16	43	260
	50	2.5	15	16	150
	53	1.5	17	37	260
04 Aug. 78	1	3.0			
	2	1.5	25	59	690
	3	3.0	22	46	545
	4		29	58	630
	5	2.0	23	53	630
	6	2.0			

Table 3. Water quality features and other environmental parameters recorded during the fall 1978 survey of the Tuktoyaktuk Peninsula coast. Locations are shown in Fig. 1.

Date	Location	Bottom Depth(m)	Wind Vel.(km/hr)	Water Temp °C	Salinity	TSS (mg/L)	Susp N (µg/L)	Susp C (µg/L)
01 Sept 78	10	1.0	E 20	4.5		66	61	515
	11	2.5	E 20	4.8		50	83	1170
	12	2.0	E 20	8.2		16	144	1505
	13	1.0	E 20	8.5		17	30	300
	14	0.6	E 20			13	38	345
	15	1.0	E 20	4.9		13	60	495
	16	1.0	E 20	7.9		12	36	340
	17	1.0	E 20	8.2		49	80	865
	18	4.0	E 20	2.9		29	66	680
	20	4-6	E 20	7.8		15	51	545
02 Sept 78	21	1.0	SE 37	6.7	14.88	24	59	630
	22	1.0	SE 37	6.5		17	46	300
	23	0.7	SE 37	7.2	16.14	17	67	590
	24	2.0	SE 37	6.6		4	35	190
	25	2.0	SE 37	5.2	22.80	18	58	465
	26	1.2	SE 37	4.5		25	122	820
	27	1.2	SE 37	2.4	29.03	21	53	460
	28	1.2	SE 37	5.9		19	58	470
	29	1.2	SE 37	3.4	27.17	13	22	240
	30	3.0	SE 37	6.0		18	54	550
03 Sept 78	31	3.0	SE 25	5.5		9	31	340
	31A	2.5	SE 25	2.1		18	35	225
	33	2.5	SE 25	2.3	30.53	20	40	275
	34	1.0	SE 25	4.4		14	44	380
	35	1.7	SE 25	5.7	19.43	17	64	475
	37	1.6	SE 25	5.3		19	13	130
	38	1.6	SE 25	5.2	22.37	11	11	80
	41	2.0	SE 25	5.4		16	35	320
	43	1.6	SE 25	4.7	22.80	14	45	380
	45	1.6	SE 25	4.4		14	37	360
04 Sept 78	1	1.2	SSE 15	6.7	10.02			
	2	1.4	SEE 15	6.3		25	79	780
	3	1.0	SSE 15	5.9	16.39	14	54	435
	4	1.4	SSE 15	6.1		23	68	625
	5	1.0	SSE 15	6.0	17.63	19	53	420
	7	0.5	SSE 15	5.1		14	34	325
	8	2.5	SSE 15	5.7		14	38	355
	9	2.0	SSE 15	4.4		16	26	245

Table 4. Water quality features and other environmental parameters recorded during the three 1979 surveys of the Tuktoyaktuk Peninsula coast. Locations are shown in Fig. 1.

Date	Location	Bottom Depth(m)	Wind Vel.(km/hr)	Water Temp °C	Salinity	Conductivity (m Siemens)	pH	Alkalinity	TSS (mg/L)	Susp N (µg/L)	TDN (µg/L)	Susp P (µg/L)	TDP (µg/L)	Chl a (µg/L)
28 Jun 79	2	2.0	SE 12	7.1		0.36	7.9	92.9	109	248				2.80
	4	1.3	SE 12	3.9		0.97	7.8	84.2	32	84				3.50
18 July 79	22a		NNE 8	14.4	2.88	7.67			3	49	300		38.4	0.80
	23		NNE 8	15.2	4.44	7.80					310		37.8	
19 July 79	30		ENE 8	11.0	10.27	16.20			10	42	340		36.7	
	31		ENE 8	12.7	8.03	13.60			15	154	230		36.4	
	31a		ENE 8	4.4	24.90	33.80			15	44	460		41.7	
	32		ENE 8	12.1					7	49	390		40.4	
1 Aug 79	1	2.5	SE 12	13.9	0.89	1.75	8.2	95.1	106	191	260	109	40.9	3.90
	4	1.7	SE 12	13.8	3.67	6.33	8.2	93.1	27	70	520	31	43.5	5.00
4 Aug 79	22a	2.8	N 8	10.8	19.42	27.90	8.2	108.7	13	57	530	11	40.0	
	23	1.8	N 8	11.8	24.47	33.80	8.1	115.7	20	37	490	15	42.3	
7 Aug 79	31	1.2	E 8	10.3	22.86	32.10	8.3	109.5	19	139	360	39		
	31a	2.7	E 8	8.9	25.53	36.60	8.0	112.1	2	42	490	17		
16 Sept 79	1	2.5	N 6	2.5	1.66	3.26	7.9	90.1	15	53	330	21		2.80
	4	1.5	N 6		16.18	15.48								

Table 5. Water quality features and other environmental parameters recorded during the spring 1980 survey of the Richards Island coast. Locations are shown in Fig. 1.

Date	Location	Bottom Depth(m)	Wind Vel.(km/hr)	Sample Depth(m)	Water Temp °C	Salinity	Conductivity (m Siemens)	pH	Alkalinity	TSS (mg/L)	Susp N (µg/L)	TDN (µg/L)	Susp P (µg/L)	TDP (µg/L)	Chl a (µg/L)
2 July 80	1		SE 25	S		0.29	0.71	8.1	74.1	61	143	190	60	16.2	2.63
	1*		SE 25	S		0.07	0.29	8.2	82.1	123	259	210	129	14.4	4.07
3 July 80	56	2.0	E 25	S	14.0	0.02	0.23	8.1	79.5	60	143	260	57	10.9	2.56
	57	5.0	E 20	S		1.44	3.00	8.0	76.5	25	107	230	27	6.9	1.60
	57	5.0		4.0		29.47	37.26	7.0	274.2			930	9	3.8	0.56
4 July 80	60	4.5	E 30	S	7.0	5.46	8.70	7.9	103.1	21	97	220		3.8	3.03
	62	6.5	NE 25	S	6.0	4.32	7.52	8.0	90.1	21	122	180		8.6	3.02
		6.5		6.0	1.0		15.75	7.7	114.7	26	86	280		8.8	4.14
	84	3.0	NE 25	S	12.2	1.18	3.08	7.8	66.1	2	71	250		7.9	1.73
		4.0		3.5	1.0	29.41	38.38	7.6	293.1	23	247	540		10.8	4.21
5 July 80	63	1.8	NE 15	S	10.3		0.22	7.8	80.1	35	51	430	6	5.1	1.40
	66	4.0	NE 20	S	9.0	4.71		7.7	71.7	47	107	130		3.1	1.77
	68	2.5	NE 15	S	9.5	4.12	6.96	7.7	63.9	27	61	130		4.1	1.19
	69	1.8	NE 15	S	9.0	2.97	5.29	7.8	62.7	25	58	130		5.0	1.67
6 July 80	71	1.0	NE 10	S	3.5	30.74	39.86	7.8	116.7	66	88	390		32.0	2.32
	77	0.7	NE 10	S	6.5	28.42	37.39	7.9	118.1	58	74	360		26.0	1.42
	78	1.0	NE 10	S	12.0	0.24	0.65	8.2	86.1	37	98	150		6.6	2.37
	83	4.0	NE 5	S	10.0	8.27	1.31	8.0	102.1	10	31	170		4.2	0.40
7 July 80	79	1.2	N 5	S	4.2	27.84	38.33	7.9	118.5	30	>23	380		25.9	0.64
	82	1.0	N 5	S	4.4	16.49	24.71	7.9	95.5	17	106	250		8.8	0.90

* This site was 200 m offshore from the entrance to the inlet.

Table 6. Water quality features and other environmental parameters recorded during the midsummer 1980 survey of the Richards Island coast. Locations are shown in Fig. 1.

Date	Location	Bottom Depth(m)	Wind Vel.(km/hr)	Sample Depth(m)	Water Temp °C	Salinity	Conductivity (m Siemens)	pH	Alkalinity	TSS (mg/L)	Susp N (µg/L)	TDN (µg/L)	Susp P (µg/L)	TDP (µg/L)	Chl a (µg/L)
1 Aug 80	1	3.0	W 5	S (surface)	10.0	0.51	1.10	7.9	72.7	28	93	240		7.6	
	1*		W 5	S	10.5	0.14	0.44	8.0	91.7	72	146	200		16.5	
2 Aug 80	56	1.5	NNW 5	S	10.7	0.04	0.25	8.1	93.3	64	133	230	53	10.1	1.00
	57	4.5	NNW 5	S	9.0	1.73	3.14	8.0	93.3	18	69	190	17	5.7	0.80
3 Aug 80	60	4.5	E 5	S	8.3	12.05	18.33	7.9	105.1	10	31	350	7	4.1	0.40
	62	9.0	NE 7	S	8.5		21.50	8.0	107.7	15	26	270	8	4.6	0.70
	84	3.5	NE 7	S	9.2		2.85			2	46	280	8	7.8	0.80
4 Aug 80	63	1.3	NW 10	S	8.8	13.56	19.69	8.0	104.1	16	31	260	12	4.4	1.20
	66	3.1	NW 12	S	8.8	18.50	26.85	8.0	114.5	24	59	230		17.0	1.40
	68	3.2	NW 12	S	9.0	19.63	28.12	8.0	117.5	18	45	320		11.0	0.80
	69	2.2	NW 12	S	7.3	26.94	36.35	7.9	116.9	195	329	330		17.7	4.60
5 Aug 80	71	1.2	SE 5	S	10.0	10.43	16.53	8.0	102.1	299	65	250	23	5.4	1.90
	77	1.0	SE 5	S	10.8	3.32	5.56	8.1	96.1	13	93	250	46	8.1	0.50
	78	1.5	SE 5	S	12.8	0.04	0.27	8.1	99.3	27	565	270	316	19.3	0.70
	83	9.5	SE 5	S	9.6	13.68	20.76	8.1	123.1	55					0.30
6 Aug 80	80	2.5	S 5	S	9.6	11.72	18.24	8.0	102.5	47	106	250	44	8.8	2.80
	81	2.3	S 5	S	9.3	18.94	28.28	7.9	104.5	89	159	420	73	9.2	2.30

* This site was 200 m offshore from the entrance to the inlet.

Table 7. Water quality features and other environmental parameters recorded during the fall 1980 survey of the Richards Island coast. Locations are shown in Fig. 1.

Date	Location	Bottom Depth(m)	Wind Vel.(km/hr)	Sample Depth(m)	Water Temp °C	Salinity	Conductivity (m Siemens)	pH	Alkalinity	TSS (mg/L)	Susp N (µg/L)	TDN (µg/L)	Susp P (µg/L)	TDP (µg/L)	Chl a (µg/L)
6 Sept 80	1	4.0	S 10	S	3.5	2.47	4.56	7.9	86.1	45	114	320	44	9.10	1.60
	1*		S 10	S		0.27	0.66	8.0		71	152	270	64	11.00	0.60
	56	2.0	S 10	S	5.9	0.06	0.29	8.2	95.5	37	92	270	33	10.70	1.20
	57	10.0	S 10	S	2.3	4.11	7.19	7.9	99.3	21	125	230	21	8.70	2.80
		9.5		7.0	0.0	29.14	37.84	7.0	298.3	25	39	530	7	9.90	0.10
7 Sept 80	60		SW 5	S	4.0	15.32	22.74	7.9	109.7	20	42	340	17	5.10	0.70
	62	5	SW 5	S	3.7	16.80	24.37	7.9	111.1	15	48	310	13	7.00	0.90
	84		SW 5	S	3.0		13.72	7.8	97.5	8	65	330	9	5.00	1.00
8 Sept 80	63	1.5	SW 5	S	3.5	16.83	24.41	7.9	111.5	20	63	290	18	7.10	2.30
	66	4.0	SW 7	S	2.4	15.17	22.39	7.9	111.5	20	76	270	21	4.80	3.30
	68	6.5	SW 7	S	1.9	13.71	20.51	7.9	112.1	22	339	270	116	5.70	1.60
	69	4.5	SW 7	S	1.9	2.67	4.90	8.0	101.1	122	112	260	25	10.20	2.70
9 Sept 80	71	1.0	SW 5	S	3.9	3.19	5.66	8.2	105.1	22	64	150	22	6.30	1.50
	77	<1.0	SW 2	S	4.5	0.07	0.34	8.1	98.7	53	102	220	48	6.30	1.20
	78	2.0	SW 5	S	6.9	0.06	0.29	8.1	98.5	23	61	250	23	6.30	1.60
	83	3.5	SW 5	S	3.7	10.89	16.97	8.0	118.7	15	44	230	10	4.10	1.00
10 Sept 80	79	1.8	N 2	S	3.3	7.99	13.06	7.9	99.3	26	44	240	23	7.20	0.50
	80		N 2	S	3.5	9.88	15.67	7.9	102.1	217	259	250	222	10.10	0.60
	81		N 7	S	3.3	6.22	10.29	7.9	99.7	142	211	220	82	8.90	0.70
	82	1.5	N 7	S	3.3	6.37	10.68	7.9	98.5	45	70	220	41	8.50	0.60

* This site was 200 m offshore from the entrance to the inlet.

Table 8. Fish species caught during the three survey years, 1978-80, from the Tuktoyaktuk Peninsula and Richards Island areas.

Common Name	Scientific Name	Abb.
broad whitefish	*Coregonus nasus* (Pallas)	BDWT
lake whitefish	*Coregonus clupeaformis* (Mitchill)	LKWT
least cisco	*Coregonus sardinella* Valenciennes	LSCS
Arctic cisco	*Coregonus autumnalis* (Pallas)	ARCS
Arctic flounder	*Liopsetta glacialis* (Pallas)	ARFL
starry flounder	*Platichthys stellatus* (Pallas)	STFL
rainbow smelt	*Osmerus mordax* (Mitchill)	RNSM
inconnu	*Stenodus leucichthys* (Guldenstadt)	INCO
ninespine stickleback	*Pungitius pungitius* (Linnaeus)	NSSB
Arctic cod	*Boreogadus saida* (Lepechin)	ARCD
fourhorn sculpin	*Myoxocephalus quadricornis* (Linnaeus)	FHSC
longnose sucker	*Catostomus catostomus* (Forster)	LNSK
Arctic grayling	*Thymallus arcticus* (Pallas)	ARGR
lake trout	*Salvelinus namaycush* (Walbaum)	LKTR
Pacific herring	*Clupea harengus pallasi* Valenciennes	PCHR
saffron cod	*Eleginus gracilis* (Tilesius)	SFCD
pond smelt	*Hypomesus olidus* (Pallas)	PDSM
trout perch	*Percopsis omiscomaycus* (Walbaum)	TPCH
northern pike	*Esox lucius* Linnaeus	NRPK
burbot	*Lota lota* (Linnaeus)	BRBT
spoonhead sculpin	*Cottus ricei* (Nelson)	SPSC

Note: Names taken from Robins et al. (1980).

Table 9. Percentage composition and total number (n) of gillnet catches from coastal locations.

	1980					1979					1978				
	Survey 1	Survey 2	Survey 3	All Surveys	(n)	Survey 1	Survey 2	Survey 3	All Surveys	(n)	Survey 1	Survey 2	Survey 3	All Surveys	(n)
Arctic cisco	10.92	9.48	11.14	10.57	(107)	12.18	11.11	22.78	13.01	(89)	8.66	8.78	27.31	16.66	(470)
Least cisco	15.85	13.73	8.06	11.96	(121)	9.07	6.35	31.65	10.67	(73)	21.64	7.93	6.37	9.39	(265)
Rainbow smelt	3.52	12.75	10.19	9.09	(92)	0.57	1.59	1.27	1.02	(7)	0	10.06	6.37	6.91	(295)
Lake whitefish	6.69	4.25	2.13	4.05	(41)	5.95	6.75	22.78	8.19	(56)	12.07	2.90	1.49	3.72	(105)
Broad whitefish	2.46	6.86	2.13	3.66	(37)	1.13	3.57	6.33	2.63	(18)	19.59	2.13	1.74	4.68	(132)
Inconnu	10.21	11.11	4.27	8.00	(81)	1.13	3.57	11.39	3.22	(22)	5.92	1.68	3.39	2.91	(82)
Longnose sucker	0.70	0.33	0	0.30	(3)	1.13	0.40	0	0.73	(5)	0.23	0	0	0.04	(1)
Northern pike	0.31	0	0	0.10	(1)	0	0	0	0	(0)	0	0	0	0	(0)
Lake trout	0	0.33	0	0.10	(1)	0	0	0	0	(0)	0	0	0	0	(0)
Fourhorn sculpin	22.89	16.99	32.70	25.20	(255)	2.83	10.32	1.27	5.41	(37)	5.47	28.73	32.75	26.83	(757)
Arctic flounder	15.49	11.76	13.27	13.44	(136)	52.97	27.38	0	37.43	(256)	16.63	23.44	11.41	17.23	(486)
Starry flounder	3.17	1.31	0.24	1.38	(14)	11.05	17.46	2.53	12.43	(85)	7.74	6.14	1.65	4.47	(126)
Saffron cod	3.17	7.19	4.98	5.14	(52)	1.42	4.76	0	2.49	(17)	0.23	2.90	4.30	4.15	(117)
Pacific herring	4.58	3.92	10.90	7.02	(71)	0.57	6.76	0	2.78	(19)	0.68	2.56	3.31	2.59	(73)
Burbot	0	0	0	0	(0)	0	0	0	0	(0)	1.14	0	0	0.81	(5)
Arctic cod	0	0	0	0	(0)	0	0	0	0	(0)	0	0.60	0	0.25	(7)
Total n	284	306	422		1012	353	252	79		684	454	1181	1209		2844

Table 10. Characteristics of location groups derived from cluster analysis of gillnet catch data. See Fig. 15-17 for maps of group (cluster) locations.

Cluster Designation	No. of Fishing Sites	Type Species (in order of frequency)	Species Diversity	No. of species/catch Range	Mean	Remarks
J 1	5	Inconnu	low	2-6	3.4	low salinity locations, East Channel, Harry Channel
J 2	11	Arctic cisco, Starry flounder	low	0-5	1.8	wide salinity range, associated with large bays (McKinley)
J 3	13	Whitefishes, ciscoes, inconnu	moderate	4-8	5.4	Principally east coast Kugmallit Bay
J 4	5	Ciscoes, whitefishes, fourhorn sculpin, Arctic flounder, inconnu	high	6-9	7.4	West coast Richards Island, Tuft Point, high to low salinity
J 5	3	Pacific herring, fourhorn sculpin, Arctic flounder, saffron cod, Arctic cisco	high	8-11	9.0	McKinley Bay to northern tip of Richards Island, salinity moderate
A 1	13	Pacific herring, fourhorn sculpin, Arctic flounder, saffron cod, least cisco, rainbow smelt, whitefishes, inconnu	mod-high	4-9	6.5	North and west Richards Island, North Kugmallit, Hutchison Bay, moderate salinity
A 2	18	Arctic flounder, Arctic cisco, fourhorn sculpin, saffron cod, starry flounder, Pacific herring	moderate	4-8	5.5	Differs from above in the absence of whitefishes and inconnu. Locations are generally east of Hutchison Bay
A 3	8	Coregonids, fourhorn sculpin, Arctic flounder	mod-high	3-9	6.8	East and Harry Channels, Kugmallit Bay west of Tuktoyaktuk
A 4	20	Fourhorn sculpin, Arctic flounder, Arctic cisco	low	0-5	3.0	East of Hutchison Bay, Barrier Islands, Mason and Mallik
S 1	10	Coregonids	mod-high	5-8	6.6	Inner estuary and Mason Bay, moderate to low salinity
S 2	20	Arctic cisco, fourhorn sculpin and miscellaneous	low	2-4	2.5	From Hooper Island to Russel Inlet, wide salinity range
S 3	8	Fourhorn sculpin, saffron cod, Arctic cisco, broad whitefish, least cisco, Pacific herring	mod-high	6-8	7.1	Tibjak Point, Tuft Point, west Mason Bay, moderate salinity
S 4	18	Saffron cod, fourhorn sculpin, Arctic cisco, Pacific herring, Arctic flounder	moderate	4-8	5.7	North Richards Island, Tuktoyaktuk Peninsula, Tibjak to McKinley Bay

Table 11. Principal prey (dry weight biomass ≥10% of total weight of n stomachs) of the major fish species taken from coastal locations.

Food Organism	Richards Island Coast										
	Least cisco	Arctic cisco	Broad whitefish	Lake whitefish	Inconnu	Pacific herring	Starry flounder	Arctic flounder	Fourhorn sculpin	Saffron cod	Rainbow smelt
N =	14	17	20	10	4	80	2	16	17	25	6
Mysidacea	21.43	31.61									12.19
Amphipoda		11.28					28.13		12.00	11.05	
Cumacea											
Copepoda	35.71										
Isopoda									26.24	11.57	
Gastropoda											
Pelecypoda			12.94	11.71			56.25	63.37			
Insect remains											
Ascidacea		10.91									
Oligochaeta				23.29							
Unidentified fish remains					72.31				29.92	24.26	85.66
Salmonidae					21.56						
Catastomidae											
Plant remains											

Food Organism	Kugmallit Bay Eastern Coast										
	Least cisco	Arctic cisco	Broad whitefish	Lake whitefish	Inconnu	Longnose sucker	Starry flounder	Arctic flounder	Fourhorn sculpin	Saffron cod	Rainbow smelt
N =	41	9	34	36	38	3	5	4	16	19	26
Mysidacea											
Amphipoda	29.41					35.85				20.22	
Cumacea		49.06									
Copepoda	13.45	13.21									
Isopoda				65.57			82.60		20.61	20.87	
Gastropoda											
Pelecypoda			10.05	40.00				51.38			
Insect remains											
Ascidacea											
Oligochaeta											
Unidentified fish remains	22.69				84.20				42.25		93.84
Salmonidae											
Catastomidae									17.02		
Plant remains						59.12					

Food Organism	Eastern Tuktoyaktuk Peninsula Coast								
	Least cisco	Arctic cisco	Lake whitefish	Pacific herring	Starry flounder	Arctic flounder	Fourhorn sculpin	Saffron cod	Rainbow smelt
N =	12	54	1	1	47	80	27	25	8
Mysidacea									
Amphipoda	11.11								
Cumacea	11.11							45.96	
Copepoda									
Isopoda	22.22	38.33		97.14					
Gastropoda							71.64		
Pelecypoda		19.54							
Insect remains			94.26		61.37	79.40			
Ascidacea	22.22								
Oligochaeta									
Unidentified fish remains									96.36
Salmonidae									
Catastomidae									
Plant remains									

Table 12. Lake morphometry and assessment of overwintering capacity (K-known, P-probable).
Note: maximum recorded depth is based on from one to three point soundings, and is not necessarily maximum lake depth. See Table 8 for species codes.

Lake	Area (ha)	Shoreline Development	Maximum Recorded Depth	Overwintering Capacity	Fish species present
Loc 1, Lake 1	132	2.26	2.8		BDWT, LKWT, LSCS, NRPK, LNSK
Lake 2	700	1.84	3.5	K	BDWT, LSCS, NRPK, BRBT
Loc 4, Lake 1	231	1.42	1.6		BDWT, LSCS, NRPK
Lake 2	325	2.32	2.0		NRPK, PDSM
Loc 22a, Lake 1	385	1.41	1.1		BDWT, LKWT, LSCS
Lake 2	87	5.45			LSCS, LKTR
Lake 3	1299	1.85	5.7	P	LKTR
Loc 23, Lake 1	632	2.38	1.2		BDWT, LKWT
Lake 2	1854	3.78	9.5	P	BDWT, LSCS, LKTR, BRBT
Lake 3	103	1.75	1.8		None caught
Loc 31, Lake 1	434	1.93	1.3		BDWT, LSCS
Lake 2	178	3.04	2.0		BDWT, LSCS
Loc 56, Lake 1	331	1.49	2.1		BDWT, LKWT, LSCS, NRPK, BRBT, LNSK
Lake 2	523	2.83	3.0	P	BDWT, LKWT, LSCS, LKTR, BRBT
Loc 57, Lake 1	127	2.02	9.0	P	BDWT, LKWT, LKTR, NRPK, BRBT
Lake 2	157	1.74	9.0	P	BDWT, LSCS, LKTR, BRBT
Loc 60, Lake 1	51	1.72	1.2		BDWT, LKWT, LSCS, NRPK
Lake 2	63	1.50	3.2	P	BDWT, LKWT, LSCS, NRPK
Loc 62, Lake 2	11	1.60	4.5	P	BDWT, LKWT, LSCS, PDSM
Loc 63, Lake 1	48	1.36	9.2	P	BDWT, LKWT, LSCS, LKTR, BRBT
Lake 2	196	1.55	1.0		BDWT, LKWT, LSCS
Loc 83, Lake 1	473	1.84	4.5	P	BDWT, LKWT, LSCS, LKTR, NRPK, BRBT
Lake 2	319	2.06	6.0	P	BDWT, LKWT, LSCS, LKTR, BRBT

Table 13. Water quality features and other environmental parameters recorded during the 1979 surveys of lakes on the Tuktoyaktuk Peninsula. Locations are shown in Fig. 1.

Date	Lake	Bottom Depth(m)	Water Temp °C	Conductivity (m Siemens)	pH	Alkalinity	TSS (mg/L)	Susp N (µg/L)	TDN (µg/L)	Susp P (µg/L)	TDP (µg/L)	Chl a (µg/L)
1 Aug 79	Loc.1, Lake 1	2.0	15.5	98.0	7.9	36.5	2	94	450	12	38.9	4.4
	Lake 2	2.2		112.0	8.9	45.5		49	360	8	36.6	2.6
	Loc.4, Lake 1	1.6	15.2	112.0	8.4	42.4	3	130	430	20	42.2	3.5
	Lake 2	2.0	15.9	154.0	9.2	64.1	2	111	440	16	40.6	5.7
7 Aug 79	Loc.22A, Lake 1	1.1	11.7	178.0	8.4	48.0	11	509	710	47	33.5	
	Lake 3	5.7	13.1	193.0	8.2	71.1		13	320	3	28.1	
	Loc.23, Lake 2	8.0	13.5	219.0	8.5	88.1		31	330	5	30.0	
	Lake 3	1.8	12.9	173.0	8.2	53.7	1	70	540	13	32.1	
	Loc.31, Lake 1	1.3	11.6	178.0	8.6	60.1	11	44	460		41.7	
	Lake 2	2.0	12.4	198.0	8.5	73.7	1	42	490	17		
16 Sept 79	Loc.1, Lake 1	2.0	2.5	127.0	7.6	40.0	2	81	570	16	43.1	5.9
	Lake 2	2.2	2.7	118.0	7.6	45.0	2	60	350	9	38.9	2.4
	Loc.4, Lake 1	1.6	1.8	132.0	7.6	44.0	10	149	470	33	40.2	11.0
	Lake 2	1.7	2.3	133.0	8.9	55.5	2	51	470	14	40.2	4.7

Table 14. Water quality features and other environmental parameters recorded during the 1980 spring survey of lakes. Locations are shown in Fig. 1.

Date	Lake	Bottom Depth(m)	Water Temp °C	Conductivity (m Siemens)	pH	Alkalinity	TSS (mg/L)	Susp N (µg/L)	TDN (µg/L)	Susp P (µg/L)	TDP (µg/L)	Chl a (µg/L)
2 July 80	Loc.1, Lake 1	2.8	12.0	79.6	7.5	26.4	2	104	360	13	9.8	5.11
	Lake 2	3.0	9.5	102.6	7.6	40.0	1	53	250	8	6.9	3.69
3 July 80	Loc.56, Lake 1	1.8	12.7	161.4	7.8	67.1	2	66	270	8	4.3	1.94
	Lake 2	2.2	11.2	108.7	7.1	31.4	1	52	210	6	4.6	1.85
	Loc.57, Lake 1	1.5	9.8		7.9	82.1	2	60	270	4	3.8	1.32
	Lake 2	8.5	10.8	201.4	7.8	78.1	1	73	250	6	5.1	2.17
4 July 80	Loc.60, Lake 1	1.2	13.0	99.4	7.5	26.4	3	164	430		6.8	4.43
	Lake 2	3.0	13.5	106.1	7.7	33.0	2	123	400		6.4	4.51
	Loc.62, Lake 2	2.0	12.7	220.9	7.8	60.1	2	101	300		6.4	3.36
5 July 80	Loc.63, Lake 1	2.2	11.0	215.2	7.9	64.7	4	87	260		4.4	3.11
	Lake 2	2.2	12.0	181.1	7.8	54.3	3	82	250		5.9	3.00
6 July 80	Loc.83, Lake 1	3.2	12.9	178.5	7.8	54.1	3	64	200		4.2	1.25
	Lake 2	6.0	13.3	158.7	7.9	60.5	3	101	260		4.2	2.46

Table 15. Water quality features and other environmental parameters recorded during the 1980 midsummer survey of lakes. Locations are shown in Fig. 1.

Date	Lake	Bottom Depth(m)	Water Temp °C	Conductivity (m Siemens)	pH	Alkalinity	TSS (mg/L)	Susp N (µg/L)	TDN (µg/L)	Susp P (µg/L)	TDP (µg/L)	Chl a (µg/L)
1 Aug 80	Loc.1, Lake 1	2.2	9.7	96.3	7.3	34.0	2	103	460		10.87	
	Lake 2	3.0	10.3	114.6	7.7	44.0	1	71	360		5.44	
2 Aug 80	Loc.56, Lake 1	2.1	9.7	163.2	8.0	65.1	1	60	250	6	4.23	0.6
	Lake 2	2.5	9.8	105.2	7.5	39.4	1	69	250	6	3.41	0.2
	Loc.57, Lake 1	2 to 5	9.0	213.8	8.0	86.1	1	31	190	3	3.74	0.2
	Lake 2	>7	8.8	205.8	8.8	82.9	1	65	260	6	8.13	0.6
3 Aug 80	Loc.60, Lake 1	1.2	11.8	101.6	7.5	28.0	2	94	416	8	7.42	2.2
	Lake 2	3.2	10.5	112.0	7.6	36.4	2	90	360	13	6.42	3.1
	Loc.62, Lake 2	4.5	9.4	205.4	8.1	74.1	1	53	340	7	5.42	1.5
4 Aug 80	Loc.63, Lake 1	9.2	9.2	217.1	7.9	66.7	1	47	250	7	4.04	0.3
	Lake 2	1.0	9.8	218.5	7.9	64.1	2	62	260	10	5.65	0.6
5 Aug 80	Loc.83, Lake 1	4.5	9.7	162.3	7.9	54.1	1	35	230	5	3.6	1.3
	Lake 2	4.1	10.2	160.8	8.1	61.5	3	52	300	8	4.3	1.8

Table 16. Water quality features and other environmental parameters recorded during the 1980 fall survey of lakes. Locations are shown in Fig. 1.

Date	Lake	Bottom Depth(m)	Water Temp °C	Conductivity (m Siemens)	pH	Alkalinity	TSS (mg/L)	Susp N (µg/L)	TDN (µg/L)	Susp P (µg/L)	TDP (µg/L)	Chl (µg/L)
6 Sept 80	Loc.1, Lake 1	1.5	3.3	113.5	7.5	38.6	3	105	490	14	11.00	3.70
	Lake 2	3.5	4.7	112.8	7.7	44.8	3	69	350	10	6.60	2.70
	Loc.56, Lake 1	2.0	3.5	160.0	7.9	62.9	1	63	310	7	6.60	1.20
	Lake 2	3.0	3.6	109.9	7.7	39.4	1	52	290	6	4.59	1.30
	Loc.57, Lake 1	9.0	5.1	223.8	8.1	87.5	1	34	220	33	4.60	1.20
	Lake 2	9.0	3.9	210.1	8.1	83.3	1	42	280	6	4.40	1.30
7 Sept 80	Loc.60, Lake 1	1.2	3.0	103.5	7.3	29.2	1	62	450	8	6.80	1.40
	Lake 2	2.0	4.0	116.2	7.5	38.0	1	67	380	8	5.70	2.20
	Loc.62, Lake 2		2.7	281.0	7.9	79.7	2	72	410	9	5.90	1.80
8 Sept 80	Loc.63, Lake 1		3.0	222.0	8.0	67.7	2	63	290	18	7.10	1.90
	Lake 2	0.7	2.1	229.0	7.9	69.1	5	69	280	14	6.30	1.60
9 Sept 80	Loc.83, Lake 1	3.5	3.5	169.0	8.0	56.5	1	41	310	9	4.30	1.00
	Lake 2	3.0	3.1	164.0	8.0	60.5	1	53	220	9	4.60	1.20

Table 17. Percentage composition and total number (n) of gillnet catches from lakes of the study area.

	1980					1979					1978				
	Survey 1	Survey 2	Survey 3	All Surveys	(n)	Survey 1	Survey 2	Survey 3	All Surveys	(n)	Survey 1	Survey 2	Survey 3	All Surveys	(n)
Broad whitefish	51.16	40.47	56.00	50.65	(313)	42.50	67.30	75.00	63.44	(210)	-	64.16	52.63	60.75	(195)
Least cisco	9.85	25.12	20.50	18.61	(115)	40.00	18.24	21.74	24.47	(81)	-	27.88	28.40	28.04	(90)
Lake whitefish	5.91	16.28	9.00	10.52	(65)	3.75	0	0	0.91	(3)	-	0.48	0	0.35	(1)
Northern pike	11.33	5.58	6.50	7.77	(48)	0	9.43		5.14	(17)	-	6.19	13.68	8.41	(27)
Lake trout	10.34	10.23	5.00	8.58	(53)	7.50	4.40	0	3.93	(13)	-	1.44	5.26	2.79	(8)
Burbot	6.90	1.86	2.50	3.72	(23)	6.25	0	1.09	1.81	(6)	-	0	0	0	(0)
Pond smelt	0	0	0.50	0.16	(1)	0	0.63	0	0.30	(1)	-	0	0	0	(0)
Total n	203	215	200		618	80	159	92		331		226	95		321

Table 18. Principal prey (dry weight biomass ≥10% of total weight of n stomachs) of major fish species taken from lakes of the study areas.

	Richards Island Lakes						Western Tuktoyaktuk Peninsula Lakes						Eastern Tuktoyaktuk Peninsula Lakes				
Food Organism	Least cisco	Broad whitefish	Lake whitefish	Lake trout	Northern pike	Burbot	Least cisco	Broad whitefish	Lake whitefish	Lake trout	Northern pike	Burbot	Least cisco	Broad whitefish	Lake whitefish	Lake trout	Burbot
N =	24	80	26	6	2	8	94	228	3	8	23	1	24	40	3	8	5
Notostraca						28.95							14.67	39.43	46.45		
Mysidacea				10.53													
Amphipoda							33.57								37.70		33.15
Cladocera													48.43				
Gastropoda	14.65	58.64	62.35				12.45	48.47	24.00	14.88				13.05			13.04
Trichoptera	13.02			30.02													
Insect remains																25.89	
Nematoda															33.33		
Unidentified fish remains				19.63						76.39	83.77					29.91	
Gasterosteidae					58.10						11.70						
Salmonidae					30.43												
Fish Eggs												62.37					
Plant remains	28.03	20.71	27.84	25.96		22.18						13.26					

Table 19. Hydrologic and biophysical information for selected streams on Tuktoyaktuk Peninsula and on Richards Island. Stream locations are shown in Fig. 1. See Table 8 for species codes.

Stream	Date	Time	Discharge m^3/sec	Velocity (m/s) Max.	Velocity (m/s) Mean	Width (m)	Depth (m) Max	Depth (m) Mean	X-Sect Area (m^2)	Water Temp.	Bottom Substrate	Fish species present
1	28 June 79											BDWT, LKWT, LSCS
	02 July 80	10:35	1.381	0.70	0.45	3.75	0.85	0.81	3.051	12.0 C		Not fished
	01 Aug. 79	15:35	0.151	0.53	0.47	2.90	0.19	0.11	0.322	17.0 C	mixed gravel bottom occa-	BDWT, LKWT, LSCS, ARGR
	01 Aug. 80	14:30	1.007	0.94	0.53	3.20	0.76	0.59	1.888	10.3 C	sionally over-	BDWT, PDSM, ARGR, NSSB
	16 Sept 79	11:30	-	0.35	-	3.36	0.46	-	-	2.4 C	lain with silt, scattered	BDWT, LSCS, ARGR, NSSB
	05 Sept 80	10:10	0.957	0.51	0.31	3.10	0.87	0.80	3.102	2.5 C	cobble and boulder	LSCS, PDSM, ARGR, NSSB
4	28 June 79											
	01 Aug. 79	13:12	0.252	0.20	0.14	5.97	0.58	0.32	1.805	16.2 C	silt, underlain by gravel	BDWT
	16 Sept 79	14:45	-	0.20	-	3.26	0.38	-	-	1.8 C		BDWT, LSCS, PDSM, NRPK
												BDWT, LSCS, PDSM, NSSB, NRPK
22A[1]	18 July 79	12:30	-	0.14		3.81	≈1					
	07 Aug. 79	15:35	Nil	Nil	Nil	2.11	0.62	0.36	0.755	13.3 C	silty sand	BDWT, LKWT, LSCS, NSSB
	19 Sept 79	17:30	Nil	Nil	Nil	-	-	-	-	1.1 C		BDWT, LSCS, FHSC
												BDWT, LSCS, NSSB, BRBT, FHSC
23[1]	18 July 79	16:40	-	0.17	-	2.69		-	-	17.0 C		
	07 Aug. 79	16:10	Nil	Nil	Nil	2.64	0.48	0.31	0.829	12.5 C	soft silty	BDWT, LKWT, LSCS, NSSB
	19 Sept 79	16:00	-	0.04	-	2.44	0.38	-	-	0.3 C	sand	BDWT, STFL
												BDWT, NSSB, BRBT
31	19 July 79	17:35	-	0.49	-	1.62		-	-		silty depre-	BDWT, LSCS, NSSB
	07 Aug. 79	12:00	0.17	0.29	-	1.55	0.50	0.38	0.595	12.0 C	ssions, sand,	BDWT, LSCS, NSSB
	19 Sept 79	15:00	-	0.21	-	1.52	0.39	-	-	1.1 C	gravel	BDWT, LSCS, NSSB, STFL
56	03 July 80	15:55	0.397	0.97	0.61	2.00	0.36	0.33	0.655	12.5 C	(@9:45 04 Jul 80)	BDWT
	02 Aug. 80	16.45	0.178	0.57	0.37	1.80	0.32	0.27	0.486	9.4 C	clean gravel	BDWT, ARGR
	06 Sept 80	17:35	0.236	0.83	0.57	1.45	0.32	0.29	0.413	2.5 C	substrate	BDWT, ARGR, NSSB
57	03 July 80	13:00	0.096	0.46	0.23	0.50	0.92	0.84	0.418	10.0 C	eroded	BDWT
	02 Aug. 80	14:15	0.159	0.69	0.44	0.80	0.64	0.45	0.362	9.4 C	peat with	BDWT, PDSM
	06 Sept 80	16:00	0.057	0.32	0.20	0.60	0.52	0.48	0.288	6.0 C	silt	NSSB, BRBT
60	03 Aug. 80	17:05	0.196	0.32	0.23	1.80	0.50	0.47	0.839	12.0 C	sand, silt,	BDWT, LKWT, PDSM, NSSB, NRPK
	07 Sept 80	14:15	0.140	0.32	0.24	1.75	0.40	0.34	0.595	2.7 C	aquatic veg.	BDWT, LKWT, ARGR, NSSB, BRBT, NRPK
62[1]	04 July 80	15:30	0.272	0.31	0.24	2.30	0.54	0.50	1.149	13.6 C	sand substrate	BDWT, LSCS, PDSM, FHSC, STFL, ARFL
	03 Aug. 80	14:30	0.169	0.19	0.09	2.80	0.92	0.65	1.821	9.9 C	over peat	BDWT, LKWT, LSCS, NSSB, ARFL
	07 Sept 80	16:00	0.105	0.32	0.19	0.90	0.89	0.61	0.551	3.0 C		BDWT, NSSB
63[1]	05 July 80	15:50	0.280	0.52	0.36	2.30	0.40	0.34	0.773	13.0 C	hard sand	BDWT, LSCS, NSSB
	05 Aug. 80	10:50	0.237	0.21	0.15	2.40	0.81	0.67	1.599		interspersed	BDWT, LKWT, NSSB
	08 Sept 80	15:30	0.198	0.36	0.20	2.50	0.54	0.39	0.980	3.0 C	with silty clay	NSSB
83	06 July 80	16:30	1.502	0.40	0.32	6.00	0.82	0.78	4.683	12.9 C	sand, scattered	Not fished
	05 Aug 80	14:50	1.392	0.36	0.30	6.40	0.80	0.71	4.570	10.0 C	gravel, cobble	BDWT

[1]Streams where discharge was influenced by tides.

Table 20. Gillnet catch per unit effort statistics for marine fish species caught at coastal locations during 1978, 1979 and 1980. (*KB = Kukjuktuk Bay data from Fallis, personal communication.)

		1980																1978	1979	1980	1978			1979
Species	Survey	79	80	81	82	78	77	83	71	69	68	66	63	62	84	60	56	1	1	1	2	3	4	4
Pacific herring	#1	0	-	-	0	0	0	0	0.29	0.97	0	0	0	0	0	0.90	0	0	-	0	0	0	0	0
	#2	-	0	0	-	0	0	0	0.36	0	0	0.24	2.20	0	0.05	0	0	0.33	0	0	-	0	0	0
	#3	0	-	-	0	0	0	1.41	0	2.79	2.29	2.03	0.29	1.02	0.83	0.89	0	0.29	0	0	0	0.8	0.27	0
Fourhorn sculpin	#1	3.59	-	-	2.33	0	3.47	0.92	3.80	1.93	0	0	0.48	0	0	2.51	0	0	-	0	0	0	0	0
	#2	-	0.29	1.50	-	0	2.55	2.29	1.09	3.74	0.47	0.72	0	0	0	2.18	0	0	0.16	0	-	0.33	0.67	0
	#3	0	-	-	4.00	0	0	4.92	10.16	12.57	3.43	4.35	2.05	9.90	0.55	2.68	0	0	0	0	0.27	0	1.33	0.18
Arctic flounder	#1	0	-	-	0	0	0.32	0	1.13	1.55	5.39	0	0.72	0	0	0.54	0	0	-	0	0	0	0	0
	#2	-	0	0	-	0	0.73	0	0	2.10	1.88	2.64	1.72	0	0	0.22	0	0	0.16	0	-	0.33	0	0.14
	#3	0	-	-	0	0	0	0	0	6.42	2.86	1.74	0.88	0	1.22	0	0	0.29	0	0.26	0	0	0	0
Starry flounder	#1	0	-	-	0	0	0	0	0	0.19	0	0	0.24	0	0.29	0.18	0	0.48	-	0.21	0	0	0	0
	#2	-	0	0	-	0	0	0	0	0.23	0	0	0	0	0.09	0.44	0	0	0	0	-	0	0.33	0.29
	#3	0	-	-	0	0	0	0	0	0	0	0	0.29	0	0	0	0	0	0.49	0.26	0	0.27	0.53	0
Saffron cod	#1	0	-	-	0	0	0	0	0	0.19	0.74	0	0.48	0	0	0.58	0	0	-	0	0	0	0	0
	#2	-	0	0	-	0	0	0	0.36	1.17	0.71	1.68	0.25	0	0	1.31	0	0.33	0	0	-	0	0	0
	#3	0	-	-	1.60	0	0	0	0	2.51	2.29	0.87	0.29	0.52	0	0	0	0	0	0	0	0	0	0
Arctic cod	#1	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0
	#2	-	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0
	#3	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	1978											1979	1978						1979	1978	1979	1978	
	5	6	7	8	9	10	11	12	13	14	15	KB*	16	17	18	20	21	22	22a	23	23	24	25
Pacific herring	0	-	-	0	-	0	-	0.35	0	0	-	0.20	-	0.04	-	0	0	-	0	-	0	-	-
	0	0.31	-	1.0	0.75	0.5	-	0	0	1.25	0.75	0.80	0.25	-	-	0	0	0	0.78	0	0	0	0
	0	-	0	0	0.53	0	0.31	0.75	1.0	0.75	0.67	0.40	1.55	0.45	0	0.63	0.25	0.5	-	0	-	0	0
Fourhorn sculpin	0	-	-	0.42	-	0.17	-	0.35	0	0.29	-	0.50	-	0.16	-	0.44	0	-	0	-	0.62	-	-
	0	2.15	-	12.5	5.0	16.0	-	0.75	0	0.50	7.0	1.50	6.25	-	-	5.33	0.59	0.15	0	5.93	0.17	0.3	0
	0	-	0.8	6.4	8.53	10.29	6.77	0.50	0.5	0.75	7.55	3.70	6.67	1.11	5.48	2.74	0.50	0.50	-	0	-	0.75	1.75
Arctic flounder	0	-	-	0	-	0	-	0.18	0	0.59	-	0	-	0.2	-	0.08	7.91	-	0.47	-	1.08	-	-
	0	0	-	0.25	0	2.0	-	3.25	1.75	2.25	5.75	1.3	1.5	-	-	0	5.93	1.78	0.70	2.37	0.87	2.67	5.04
	0	-	0	0.27	1.6	0	0	2.75	0	4.75	0.89	3.6	0.45	0.89	0	0	2.5	7.0	-	0.75	-	0.5	5.0
Starry flounder	0	-	-	0	-	0	-	0	1.17	0	-	0	-	0.12	-	0.08	2.54	-	2.05	-	0.15	-	-
	0.67	0.93	-	0	0	0	-	0	0.5	0.75	0	0	0	-	-	0	0.15	2.82	0.35	2.52	2.95	0.89	0
	0	-	0	0.27	0	0	0	0	0	0	0	1.7	0	0.22	0	0	0.50	1.25	-	0.50	-	0	0
Saffron cod	0	-	-	0	-	0	-	0	0	0.15	-	0.2	-	0	-	0	0	-	0	-	0	-	-
	0	0	-	0	0.25	2.5	-	0.5	0.25	0.75	2.0	0.9	2.75	-	-	0	0.45	0	0.09	1.63	0.26	0.15	0
	0	-	0	0.27	1.07	1.43	0.31	0.75	1.0	0.75	1.33	0.6	1.33	0.89	0	0.21	0.25	1.25	-	0	-	0	1.0
Arctic cod	0	-	-	0	-	0	-	0	0	0	-	0	-	0	-	0	0	-	0	-	0	-	-
	0	0	-	0	0	0	-	0	0	0	0	0	0	-	-	1.04	0	0	0	0	0	0	0
	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	-	0	0

Table 20. Cont'd

	1978						1979	1978	1979	1978	1979	1978											
	26	27	28	29	30	31	31	31A	31A	32	32	33	34	35	37	38	40	41	43	45	46	50	53
Pacific herring	0	-	-	-	-	-	0.31	-	0.16	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	-	0	0.57	0	0	0.29	0.25	0.29	0.82	0.27	-	0.27	0	0	0.62	0.31	0.31	0.31	0	0.31	0	0	0
	0	0.25	0.50	0.25	0.5	0.17	-	0	-	-	-	0	0	0	-	0	-	0	0	0	-	-	-
Fourhorn sculpin	0.15	-	-	-	-	0	0.94	-	0.16	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	-	0.3	2.86	0.86	0.86	1.43	1.02	1.14	2.31	0.27	-	0	1.87	5.54	0.31	1.23	0.93	0	1.54	0	0.31	0.57	0
	2.0	8.5	0.50	15.75	0	0	-	3.83	-	-	-	2.73	1.33	0.20	0.21	0.67	-	0	1.0	0.8	-	-	-
Arctic flounder	0.75	-	-	-	-	-	21.73	-	0	-	7.83	-	-	-	-	-	-	-	-	-	-	-	-
	-	2.52	4.0	0.29	5.14	2.86	1.40	20.0	5.71	0.80	-	1.6	7.2	4.93	1.23	1.23	0.93	0.31	0.93	0	0.31	0.29	0.67
	5.25	0.50	6.75	0	1.0	0	-	0.52	-	-	-	0	0.95	0	0	0	-	0	0	0	-	-	-
Starry flounder	0	-	-	-	-	-	3.46	-	0	-	0.74	-	-	-	-	-	-	-	-	-	-	-	-
	-	0.15	0	0	0.57	0.86	0	9.71	0.54	0	-	2.93	0	0.31	0	0.31	0	0	0	0	0	0	0
	0	0	0	0.5	0.25	0.17	-	0.70	-	-	-	0	0	0	0	0	-	0	0	0	-	-	-
Saffron cod	0	-	-	-	-	-	0.79	-	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	-	0	0	0	0	0	0	2.0	1.09	0	-	0.27	0.27	0	0	0	0.31	0	0	0	0	2.29	0.67
	0	0.75	0.25	0.25	0.25	0	-	0.18	-	-	-	0	0.19	0	0	0	-	0	0	0	-	-	-
Arctic cod	0	-	-	-	-	-	0	-	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	-	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	-	0	-	-	-	0	0	0	0	0	-	0	0	0	-	-	-

	Total Locations Fished	Number of Capture Locations	CUE				Freq. of Occurrence %
			mean	max	min	SD	
Pacific herring	38	8	0.40 (n=8)	0.97	0.04	0.34	21
	60	26	0.54 (n=26)	2.20	0.05	0.44	43
	57	28	0.80 (n=28)	2.79	0.17	0.66	49
Fourhorn sculpin	38	19	1.22 (n=19)	3.80	0.15	1.28	50
	60	44	2.35 (n=44)	16.00	0.15	3.22	73
	57	43	3.70 (n=43)	15.75	0.20	3.87	75
Arctic flounder	38	15	3.32 (n=15)	21.73	0.08	5.77	39
	60	44	2.50 (n=44)	20.00	0.14	3.27	73
	57	26	2.29 (n=26)	6.75	0.26	2.21	46
Starry flounder	38	13	1.76 (n=13)	3.46	0.08	3.40	34
	60	22	1.30 (n=22)	9.71	0.09	2.11	37
	57	15	0.53 (n=15)	1.70	0.17	0.42	26
Saffron cod	38	7	0.49 (n=7)	1.04	0.15	0.34	18
	60	28	0.94 (n=28)	2.75	0.09	0.79	47
	57	27	0.83 (n=27)	2.51	0.18	0.63	47
Arctic cod	38	0	0	-	-	-	0
	60	1	1.04 (n=1)	-	-	-	2
	57	0	0	-	-	-	0

Table 21. Gillnet catch per unit effort statistics for anadromous and freshwater fish species caught at coastal locations during 1978, 1979 and 1980. (*KB = Kukjuktuk Bay data from Fallis, personal communication.)

		1980																1978	1979	1980	1978			1979
Species	Survey	79	80	81	82	78	77	83	71	69	68	66	63	62	84	60	56	1	1	1	2	3	4	4
Arctic cisco	#1	0	-	-	0.78	0	0	0	0	1.74	0	0.96	2.16	0	0	1.25	0	0	-	0.21	0.61	0.36	0.36	0
	#2	-	0	0.16	-	0.36	0.73	0	2.18	0.23	1.88	0	0	0	0	0	2.0	0	0.31	0	-	0	1.33	1.16
	#3	8.33	-	-	0.80	0	2.50	2.11	5.47	0	3.43	2.03	0.88	0	0.06	0.89	0.78	2.29	0	0.26	0	0.53	0.80	3.25
Broad whitefish	#1	0	-	-	0	0	0.32	0	0.29	0.19	0.24	0	0	0	0.10	0	0	1.70	-	0	1.21	0.36	0.6	0.14
	#2	-	0	0	-	0	0.36	1.14	0	0	1.41	1.92	0.24	0	0	0	0.22	0.67	0.62	0	-	0.33	0	0.14
	#3	0	-	-	0	0	0	1.41	0	0	0	0.29	0.29	0	0.06	0.89	0.26	0.57	0.49	0.26	0.8	0.53	0	0.54
Lake whitefish	#1	0	-	-	0	0.94	0	0	0	0.39	0	0	0.96	0	0.14	0.18	0	0.24	-	1.71	2.05	0.61	0.24	0.27
	#2	-	0	0	-	1.09	0	0	0.36	0	0.47	0	0.25	0	0	0.22	1.11	2.33	0.47	0	-	0	1.67	2.17
	#3	0	-	-	0	0.85	0	1.41	0	0	0.29	0	0.58	0	0	0	0.53	0.86	2.70	0.26	0.27	0.53	1.07	1.44
Least cisco	#1	0	-	-	0	0	3.47	0	1.76	1.16	0	0	0.96	0	0.05	0	0	0	-	3.85	1.09	0	2.52	0.45
	#2	-	0	1.81	-	0	4.72	1.14	1.82	1.87	0.94	0	0.98	0	0.09	0	0	1.33	0.31	0.43	-	0	5.33	0.14
	#3	1.85	-	-	0	5.12	0	2.11	1.56	0.28	0	0.88	0	0	0.17	0	0.78	1.14	2.45	3.42	0	0.08	10.67	2.71
Rainbow smelt	#1	0	-	-	1.17	0	0.32	0	1.46	0.19	0	0	0	0	0	0	0	0	-	0	0	0	0	0
	#2	-	0.29	4.5	-	0	3.64	0	1.82	0.70	0	1.20	0.25	0	0	0	0	0	0	-	0	0	0.33	0.14
	#3	1.85	-	-	0.80	0.85	0	12.7	0	5.02	0.29	1.15	0	0	0	0	0	4.57	0	0	0.8	0	3.2	0.18
Inconnu	#1	0.60	-	-	0	0.63	1.26	0	0.58	0.58	0.98	0	0	0	0	0.18	0.17	0.12	-	3.0	0.48	0.61	0.60	0.14
	#2	-	0	0	-	1.09	3.28	0	0.36	0	0	0.48	1.47	0	0	0	1.33	2.0	0.31	3.43	-	0.33	1.00	1.01
	#3	0	-	-	0	0.85	0	1.41	1.56	0	0.29	0.29	0	0	0	0	1.04	4.29	0.98	2.63	1.87	0.53	0.53	0.90
Burbot	#1	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0.12	-	0	0	0	0.12	0
	#2	-	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0
	#3	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.31	0	0

	1978											1979	1978						1979	1978	1979	1978	
	5	6	7	8	9	10	11	12	13	14	15	KB*	16	17	18	20	21	22	22a	23	23	24	25
Arctic cisco	0.12	-	-	0.42	-	0.17	-	0.35	0.43	0.15	-	0.7	-	0.24	-	0.20	0.14	0	0.95	-	0.77	-	-
	0	0.31	-	0	0	0	-	0.25	0.25	1.0	0	1.5	0.50	-	-	0	0	0.15	0	0.15	0.35	2.1	0.15
	0.80	-	0	4.27	5.6	2.86	0	1.50	1.0	1.50	6.45	5.3	1.33	3.11	0	2.74	7.25	2.50	-	1.0	-	1.75	3.75
Broad whitefish	0.12	-	-	0.98	-	1.67	-	1.91	1.32	0.73	-	0	-	0.28	-	0.12	0.29	-	0	-	0	-	-
	0	0	-	0	0.25	0.5	-	2.0	2.5	0	0	0.7	0	-	-	0	0.15	0	0.09	0	0.17	0	0
	0	-	0.27	0.53	0	0.29	0	2.0	0.75	0	0.45	2.3	0.45	0	0	0	0.25	0	-	0	-	0	0
Lake whitefish	0.71	-	-	0.14	-	0.33	-	1.74	0	0.15	-	0	-	0.24	-	0.20	0	-	0	-	0	-	-
	0	0.31	-	0.25	0.5	1.75	-	1.25	0	1.0	0	0.5	0.25	-	-	0	0.3	0	0.09	0	0	0	0
	0.8	-	0	0	0	0	0	1.0	0.25	0	0	0	0	0	0	0	0	0	-	0	-	0	0
Least cisco	1.43	-	-	3.77	-	3.0	-	0.87	0.15	0.59	-	0	-	0.12	-	0.16	0	-	0	-	0	-	-
	1.33	1.85	-	0.5	8.5	0.5	-	0.25	0.50	1.25	1.0	1.5	0.25	-	-	0	0.45	0.15	0.26	0.15	0.87	0	0
	0	-	0	0.27	0	8.0	0	0	0.75	0	0	0.6	0	0.22	0	0.21	0	0	-	0	-	0	0.25
Rainbow smelt	0	-	-	0	-	0	-	0	0	0	-	0	-	0	-	0	0	-	0	-	0	-	-
	0.33	0	-	4.5	14.5	2.75	-	5.5	0	0	0.5	3.3	0.25	-	-	0	0.75	0	0.26	0	0	0	0
	0.53	-	0	0.27	3.47	1.14	3.08	0	0.75	1.0	0.67	1.1	1.33	2.89	0.63	1.26	0	0	-	0	-	0	0
Inconnu	0.48	-	-	0.28	-	0.33	-	0	0	0.44	-	0	-	0.04	-	0.08	0	-	0	-	0	-	-
	1.0	0.31	-	0	0	0.25	-	0.25	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0
	3.47	-	0	0	0	0	0	0	0	0	0.22	0	0	0	0	0	0	0	-	0	-	0	0
Burbot	0.36	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0	0	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 21. cont'd

	1978					1978	1979	1978	1979	1978	1979	1978											
	26	27	28	29	30	31	31	31A	31A	32	32	33	34	35	37	38	40	41	43	45	46	50	53
Arctic cisco	0.75	-	-	-	-	-	0.16	-	0	-	4.58	-	-	-	-	-	-	-	-	-	-	-	-
	-	0	2.00	0.86	0	0	0.89	0.57	1.09	2.13	-	2.67	0	0	1.85	0.62	2.15	3.38	1.85	1.54	0.31	1.14	2.33
	3.50	1.75	0.75	8.00	4.50	0	-	2.96	-	-	-	2.18	1.14	0.40	2.10	0.67	-	0.47	3.00	1.07	-	-	-
Broad whitefish	0	-	-	-	-	-	0	-	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	-	0	0	0	0	0	0.13	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	-	0	-	-	-	0	0	0	0	0	-	0	0	0	-	-	-
Lake whitefish	0.30	-	-	-	-	-	0	-	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	-	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	-	0	-	-	-	0	0	0	0	0	-	0	0	0	-	-	-
Least cisco	0	-	-	-	-	-	0.47	-	0.16	-	1.48	-	-	-	-	-	-	-	-	-	-	-	-
	-	0.30	0	0.57	0	0	0	0.29	0.14	0	-	1.6	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	-	0	-	-	-	0	0	0	0	0	-	0	0	0	-	-	-
Rainbow smelt	0	-	-	-	-	-	0.31	-	0	-	0	-	-	-	-	-	-	-	-	-	-	-	-
	-	0	0	0	0	0	0	0	0	0	-	0	0.27	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	-	0	-	-	-	0	0	0	0	0	-	0	0	0	-	-	-
Inconnu	0	-	-	-	-	-	0	-	0	-	0.15	-	-	-	-	-	-	-	-	-	-	-	-
	-	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	-	0	-	-	-	0	0	0	0	0	-	0	0	0	-	-	-
Burbot	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	Total Locations Fished	Number of Capture Locations	CUE				Freq. of Occurrence %
			mean	max	min	SD	
Arctic cisco	38	24	0.75 (n=24)	4.58	0.12	0.97	63
	60	37	1.12 (n=37)	3.38	0.15	0.86	62
	57	47	2.44 (n=47)	8.33	0.40	2.07	82
Broad whitefish	38	19	0.66 (n=19)	1.90	0.10	0.61	50
	60	19	0.71 (n=19)	2.50	0.09	0.71	32
	57	21	0.65 (n=21)	2.30	0.06	0.58	37
Lake whitefish	38	19	0.61 (n=19)	2.05	0.14	0.60	50
	60	20	0.82 (n=20)	2.33	0.09	0.69	33
	57	15	0.85 (n=15)	2.70	0.25	0.64	26
Least cisco	38	20	1.38 (n=20)	3.85	0.05	1.28	53
	60	34	1.26 (n=34)	8.50	0.14	1.72	57
	57	21	2.07 (n=21)	10.67	0.08	2.76	37
Rainbow smelt	38	5	0.72 (n= 5)	1.46	0.19	0.56	13
	60	20	2.29 (n=20)	14.50	0.14	3.36	33
	57	24	2.06 (n=24)	12.70	0.18	2.64	42
Inconnu	38	21	0.56 (n=21)	3.00	0.04	0.64	55
	60	16	1.11 (n=16)	3.43	0.25	1.01	27
	57	15	1.39 (n=15)	4.29	0.22	1.21	26
Burbot	38	3	0.20 (n= 3)	0.36	0.12	0.14	8
	60	0	0	-	-	-	0
	57	1	0.31 (n= 1)	-	-	-	2

Table 22. Gillnet catch per unit effort statistics for fish species caught in lakes during 1979 and 1980.

Species	Survey	1980 83 1	83 2	63 1	63 2	62 2	60 1	60 2	57 1	57 2	56 1	56 2	1 1	1 2	1979 1 1	1 2	4 1	4 2	22A 1	22A 2	22A 3
Broad whitefish	#1	0.23	0.12	0.10	1.37	0.88	1.12	0.24	0.13	0.04	0.17	0	1.28	0.30	-	-	0.66	-	0.44	0	-
	#2	0.10	0.10	0.25	0.26	0.62	0.69	0.87	0.15	0.25	0.47	0.06	0.71	0	1.43	0.56	1.40	0	0.67	-	0
	#3	0.52	0	0.42	0.42	0.61	1.17	0.33	0.11	0.68	0.77	0.06	0.87	0.21	0.74	0.74	2.31	0	-	-	-
Lake whitefish	#1	0	0.17	0.05	0.11	0.05	0.18	0	0	0	0	0.17	0	0	-	-	0	-	0.17	0	-
	#2	0.05	0.70	0.10	0.10	0.09	0.17	0.06	0	0	0	0.06	0.45	0.31	0	0	0	0	0	-	0
	#3	0.09	0.29	0.05	0	0	0.10	0	0.05	0	0.26	0.13	0	0	0	0	0	0	-	-	-
Least cisco	#1	0	0.06	0.10	0	0.59	0.06	0	0	0.04	0	0.11	0.04	0	-	-	0.77	-	0.55	0.07	-
	#2	0.10	0.25	0	1.02	0.95	0.06	0.12	0	0.29	0.35	0	0.10	0	0.17	0	0.36	0	0.52	-	0
	#3	0.35	0.07	0.11	0.59	0.33	0	0.11	0	0.05	0.83	0	0.04	0.37	0.74	0.74	0.10	0	-	-	-
Lake trout	#1	0.51	0.06	0.21	0	0	0	0	0.04	0.40	0	0.11	0	0	-	-	0	-	0	0.03	-
	#2	0.15	0.29	0.15	0	0	0	0	0	0.25	0	0.29	0	0	0	0	0	0	0	-	0.19
	#3	0.43	0.11	0.05	0	0	0	0	0.21	0.16	0	0.06	0	0	0	0	0	0	-	-	-
Northern pike	#1	0	0.13	0	0	0	0.06	0.54	0	0	0.11	0.34	0	0.21	-	-	0	-	0	0	-
	#2	0.05	0	0	0	0	0.12	0.12	0	0	0.06	0	0	0.21	0.17	0.39	0.05	0.04	0	-	0
	#3	0	0	0	0	0	0	0.44	0.05	0	0.26	0	0.04	0.12	0	0.05	0.05	0	-	-	-
Burbot	#1	0.28	0.06	0.36	0	0	0	0	0	0	0	0.23	0	0.13	-	-	0	-	0	0	-
	#2	0	0.05	0.05	0	0	0	0	0.05	0	0	0.06	0	0	0	0	0	0	0	-	0
	#3	0	0.14	0.11	0	0	0	0	0	0.05	0.13	0.06	0	0	0	0.05	0	0	0	-	-
Longnose sucker	#1	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	0	-	0	0	-
	#2	0	0	0	0	0	0	0	0	0	0.22	0	0	0	0.16	0	0	0	0	-	0
	#3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-
Pond smelt	#1	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	0	-	0	0	-
	#2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0	-	0
	#3	0	0	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0.15	0	-	-

Species	1979 23 1	23 2	23 3	31 1	31 2	Total Locations Fished	Locations Where Fish Caught	CUE mean	CUE max	CUE min	CUE SD	Freq. of Occurrence %
Broad whitefish	0.27	0	-	-	-	18	15	0.49 (15)	1.37	0.04	0.46	83
	-	0.11	0	0.53	0.54	23	19	0.51 (19)	1.43	0.06	0.40	83
	-	-	-	-	-	17	15	0.66 (15)	2.31	0.11	0.55	88
Lake whitefish	0.03	0	-	-	-	18	8	0.12 (8)	0.17	0.03	0.06	44
	-	0	0	0	0	23	9	0.20 (9)	0.70	0.05	0.23	39
	-	-	-	-	-	17	7	0.14 (7)	0.29	0.05	0.10	41
Least cisco	0	0.03	-	-	-	18	11	0.22 (11)	0.77	0.03	0.27	61
	-	0.05	0	0.14	0.10	23	15	0.31 (15)	1.02	0.05	0.31	65
	-	-	-	-	-	17	13	0.34 (13)	0.83	0.04	0.29	76
Lake trout	0	0.14	-	-	-	18	8	0.19 (8)	0.51	0.03	0.18	44
	-	0.43	0	0	0	23	7	0.25 (7)	0.43	0.15	0.10	30
	-	-	-	-	-	17	6	0.17 (6)	0.43	0.05	0.14	35
Northern pike	0	0	-	-	-	18	6	0.23 (6)	0.54	0.06	0.18	33
	-	0	0	0	0	23	9	0.13 (9)	0.39	0.04	0.11	39
	-	-	-	-	-	17	7	0.14 (7)	0.44	0.04	0.15	41
Burbot	0	0.31	-	-	-	18	6	0.23 (6)	0.36	0.06	0.11	33
	-	0	0	0	0	23	4	0.05 (4)	0.06	0.05	0.01	17
	-	-	-	-	-	17	6	0.09 (6)	0.14	0.05	0.04	35
Longnose sucker	0	0	-	-	-	18	0	0	-	-	-	0
	-	0	0	0	0	23	2	0.19 (2)	0.22	0.16	0.04	9
	-	-	-	-	-	17	0	0	-	-	-	0
Pond smelt	0	0	-	-	-	18	0	0	-	-	-	0
	-	0	0	0	0	23	1	0.04 (1)	-	-	-	4
	-	-	-	-	-	17	2	0.11 (2)	0.15	0.06	0.06	12

Table 23. Hoop net catch per unit effort statistics for marine fish species caught during 1979 and 1980.

			1980	1979		
Species	Survey	Direction	62	22a	23	31
Fourhorn sculpin	#1	upstream	0.05	0	0	0
		downstream	0	0	0	0
	#2	upstream	0	0	0	0
		downstream	0	0.10	0	0
	#3	upstream	0	0.05	0	0
		downstream	0	1.04	0	0
Starry flounder	#1	upstream	0	0	0	0
		downstream	0	0	0	0
	#2	upstream	0	0	0.05	0
		downstream	0	0	0	0
	#3	upstream	0	0	0	0.05
		downstream	0	0	0	0
Arctic flounder	#1	upstream	0.05	0	0	0
		downstream	0	0	0	0
	#2	upstream	0.05	0	0	0
		downstream	0	0	0	0
	#3	upstream	0	0	0	0
		downstream	0	0	0	0

Table 24. Hoop net catch per unit effort statistics for anadromous and freshwater fish species caught during 1979 and 1980.

			1980							1979				
Species	Survey	Direction	83	63	62	60	57	56	1	1	4	22a	23	31
Broad whitefish	#1	upstream	-	0.06	0.32	-	0.05	0	-	0.21	3.28	2.28	62.15	0.74
		downstream	-	0.06	3.46	-	0	0.58	-	0	0	0.56	0.65	0.05
	#2	upstream	0.06	0.11	1.44	1.31	0	0.19	1.08	5.09	42.0	24.50	318.00	564.00
		downstream	0.12	0.17	0.41	1.06	0.05	0	0	15.66	0	5.54	4.24	19.27
	#3	upstream	-	0	0.06	0.05	0	0	0	0.05	0.31	0.61	1.09	0.16
		downstream	-	0	0	0.10	0	0.17	0	1.87	3.52	2.14	3.38	0.64
Humpback whitefish	#1	upstream	-	0	0	-	0	0	-	0.08	0	0.30	0	0
		downstream	-	0	0	-	0	0	-	0	0	0.13	0.05	0
	#2	upstream	0	0	0	0	0	0	0	0	0	0	0	0
		downstream	0	0.11	0.10	0.44	0	0	0	0.82	0	0	0	0
	#3	upstream	-	0	0	0	0	0	0	0	0	0	0	0
		downstream	-	0	0	0.05	0	0	0	0	0	0	0	0
Least cisco	#1	upstream	-	0	0	-	0	0	-	0.08	0	0.47	0.30	0.05
		downstream	-	0.06	6.32	-	0	0	-	0	0	0.90	0.65	0
	#2	upstream	0	0	0.05	0	0	0	0	20.05	0	0.98	0	0
		downstream	0	0	0	0	0	0	0	7.85	0.04	0.10	0	0.33
	#3	upstream	-	0	0	0	0	0	0	0	0.05	0.10	0	0
		downstream	-	0	0	0	0	0	0.10	13.00	9.00	0.22	0	0.26
Pond smelt	#1	upstream	-	0	0.05	-	0	0	-	0	0	0	0	0
		downstream	-	0	0	-	0	0	-	0	0	0	0	0
	#2	upstream	0	0	0	0	0	0	0.16	0	1.26	0	0	0
		downstream	0	0	0	0.19	0.05	0	0	0	0	0	0	0
	#3	upstream	-	0	0	0	0	0	0	0	0.20	0	0	0
		downstream	-	0	0	0	0	0	0.64		11.50	0	0	0
Arctic grayling	#1	upstream	-	0	0	-	0	0	-	0	0	0	0	0
		downstream	-	0	0	-	0	0	-	0	0	0	0	0
	#2	upstream	0	0	0	0	0	0.06	0.05	2.55	0	0	0	0
		downstream	0	0	0	0	0	0.06	0	0	0	0	0	0
	#3	upstream	-	0	0	0	0	0.17	0	0	0	0	0	0
		downstream	-	0	0	0.05	0	0	0.40	0.05	0	0	0	0
Ninespine stickleback	#1	upstream	-	3.12	0.97	-	0	0	-	0	0	0.04	0.05	0.14
		downstream	-	23.53	0	-	0	0	-	0	0	0	0	0.14
	#2	upstream	0	28.00	0.36	0.13	0	0	0	0	0	0	0	0
		downstream	0	11.10	0	0.06	0	0	0.54	0	0	0	0	0.38
	#3	upstream	-	0.11	0	0.10	0	0	0	0	0.25	16.50	1.14	106.00
		downstream	-	0.17	2.87	2.52	5.48	11.65	42.86	780.0	51.00	16.50	0	690.00
Burbot	#1	upstream	-	0	0	-	0	0	-	0	0	0	0	0
		downstream	-	0	0	-	0	0	-	0	0	0	0	0
	#2	upstream	0	0	0	0	0	0	0	0	0	0	0	0
		downstream	0	0	0	0	0	0	0	0	0	0	0	0
	#3	upstream	-	0	0	0	0.05	0	0	0	0	0	0.05	0
		downstream	-	0	0	0.35	0	0	0	0	0	2.03	0.10	0
Northern pike	#1	upstream	-	0	0	-	0	0	0	0	0	0	0	0
		downstream	-	0	0	-	0	0	0	0	0	0	0	0
	#2	upstream	0	0	0	0.13	0	0	0	0	0.21	0	0	0
		downstream	0	0	0	0	0	0	0	0	0	0	0	0
	#3	upstream	-	0	0	0.10	0	0	0	0	0.15	0	0	0
		downstream	-	0	0	0.05	0	0	0	0	0.25	0	0	0

Table 25. Mean total length ($\overline{T.L.}$), standard deviation (SD), number (n) and length range of fourhorn sculpin caught during 1978, 1979 and 1980.

		Age (yrs)														
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1980	$\overline{T.L.}$				151	181	206	225	246	249	260	249	282	259	319	
All	SD				-	23	23	13	21	14	31	11	-	-	-	
Surveys	n				1	6	9	20	15	9	6	3	1	1	1	
	max				-	199	249	258	273	274	307	257	-	-	-	
	min				-	146	168	200	213	231	224	237	-	-	-	
1979	$\overline{T.L.}$				158		193	220	241	262	280					
All	SD				1		3	12	14	13	19					
Surveys	n				2		3	11	8	7	4					
	max				159		195	240	268	279	296					
	min				157		190	297	225	240	256					
1978	$\overline{T.L.}$		85	112	169	185	197	212	221	230	232	260	250	261	280	299
All	SD		-	23	21	21	21	22	23	25	26	39	30	36	37	42
Surveys	n		1	8	40	88	165	127	90	77	67	35	18	12	5	3
	max		-	143	214	269	250	265	297	290	300	347	337	334	344	346
	min		-	77	100	137	126	145	171	171	171	209	211	212	255	265
1978	$\overline{T.L.}$			130	175	190	202	221	227	233	230	253	253	254	267	299
Survey 3	SD			-	16	18	17	20	23	20	24	30	19	28	12	42
Females	n			1	17	35	63	38	22	29	27	10	9	8	3	3
	max			-	198	240	250	265	261	270	300	320	291	318	278	346
	min			-	145	148	153	179	171	183	200	222	237	222	255	265
1978	$\overline{T.L.}$			125	171	181	196	197	206	212	218	219	218			
Survey 3	SD			26	18	19	18	20	21	18	18	6	5			
Males	n			2	12	23	29	23	9	6	8	2	3			
	max			143	196	220	234	243	246	240	243	223	223			
	min			106	145	155	147	145	178	196	191	215	214			

Table 26. Sexual maturity analysis of fourhorn sculpins caught in gillnets.

				Sexual Maturity				
Year	Survey	N	Sex(%)	Immature (%)	Mature (%)	Ripe (%)	Spent (%)	Sex(%) Unknown
1980	1	53	M(26)	26	0	0	0	0
			F(74)	72	0	0	2	
	2	8	M(12)	12	0	0	0	0
			F(88)	88	0	0	0	
	3		Insufficient Number Examined					
1979	1	10	M(20)	20	0	0	0	0
			F(80)	80	0	0	0	
	2	18	M(22)	22	0	0	0	6
			F(72)	72	0	0	0	
	3		Insufficient Number Examined					
1978	1	23	M(0)	0	0	0	0	0
			F(100)	22	78	0	0	
	2	329	M(29)	22	6	0	0	1
			F(70)	52	18	0	<1	
	3	394	M(30)	14	16	0	0	2
			F(68)	34	34	0	0	

Table 27. Fourhorn sculpin gillnet catch summary statistics, 1978, 1979 and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean T.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range T.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island 1, 56-84	15	14	M	6.1	1.8	219.3	35.8	80.4	46.7	4 - 10	146 - 307	20 - 215
					39	F	6.9	1.8	237.4	30.4	105.2	40.9	3 - 13	151 - 319	20 - 260
					65 (60)	T	6.6	1.9	229.9	33.7	96.4	43.7	3 - 13	146 - 319	20 - 260
1979	1	28-29 June 18-20 July	Tuk. Peninsula 4, 22a, 23 31, 31a, 32	6	2	M	5.5	-	197.0	-	62.5	-	5 - 6	190 - 204	55 - 70
					8	F	6.5	2.4	232.6	51.1	141.3	71.0	3 - 9	157 - 296	50 - 240
					10	T	6.3	2.2	225.5	47.6	125.5	70.9	3 - 9	157 - 296	50 - 240
1978	1	26-29 June	Tuk. Peninsula 1-26	15	0	M									
					23	F	8.8	2.2	230.7	30.6	103.0	46.6	4 - 12	172 - 297	50 - 225
					24 (22)	T	8.8	2.2	238.1	37.1	112.3	64.3	4 - 12	172 - 338	50 - 325
1980	2	01-06 Aug.	Richards Island 1, 56-84	15		M									
						F	Not Reported								
					52 (8)	T	7.9	2.0	221.4	43.5	88.5	42.5	6 - 12	74 - 280	5 - 200
1979	2	01-07 Aug.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a	6	4	M	7.0	0.8	230.8	8.3	102.3	6.8	6 - 8	220 - 240	94 - 110
					13	F	7.5	1.0	252.2	21.5	147.7	43.7	6 - 9	219 - 294	95 - 250
					26	T	6.9	1.1	232.4	23.7	117.8	49.9	5 - 9	122 - 294	14 - 250
1978	2	30 July - 05 Aug.	Tuk. Peninsula 1 to 53	38	94 (88)	M	6.4	1.7	198.8	28.7	60.5	29.2	3 - 9	126 - 265	13 - 175
					231 (225)	F	6.6	1.9	220.7	36.9	93.2	59.8	3 - 13	135 - 347	15 - 400
					337 (324)	T	6.5	1.9	212.8	37.7	82.6	54.7	2 - 13	77 - 347	6 - 400
1980	3	05-10 Sep.	Richards Island 1, 56-84	15		M									
						F	Not Reported								
					138 (83)	T	-	-	223.0	30.9	89.7	37.9	-	104 - 321	8 - 250
1979	3	16-20 Sep.	Tuk. Peninsula 1, 4	2	0	M	-	-	-	-	-	-	-	-	-
					1	F	7.0	-	268.0	-	220.0	-	-	-	-
					1	T	7.0	-	268.0	-	220.0	-	-	-	-
1978	3	01-04 Sep.	Tuk. Peninsula 1 to 45	39	119 (117)	M	5.6	2.0	192.9	24.5	54.6	19.9	2 - 11	106 - 246	10 - 108
					269 (265)	F	6.6	2.5	217.0	31.6	93.6	52.0	2 - 14	130 - 346	20 - 400
					396 (390)	T	6.2	2.5	208.5	34.2	81.3	50.3	1 - 14	85 - 346	4 - 400
1980	all	01 July - 10 Sep.	Richards Island 1, 56-84	45		M							-	-	-
						F	Not Reported						-	-	-
					255 (72)	T	6.8	1.9	224.4	34.5	91.5	41.0*	3 - 13	74 - 321	5 - 260
1979	all	28 June - 20 Sep.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a, 32	14	6	M	6.5	1.0	219.5	19.1	89.0	21.7	5 - 8	190 - 240	55 - 110
					22	F	7.1	1.7	245.8	35.4	148.6	55.1	3 - 9	157 - 296	50 - 250
					37	T	6.7	1.5	231.5	37.5	122.7	57.2	3 - 9	122 - 269	14 - 250
1978	all	26 June - 04 Sep.	Tuk. Peninsula 1 to 53	92	213 (205)	M	5.9	1.9	195.5	26.5	57.2	24.6	2 - 11	106 - 265	10 - 175
					523 (512)	F	6.7	2.3	219.3	34.1	93.8	55.3	2 - 14	130 - 347	15 - 400
					757 (736)	T	6.4	2.3	211.2	36.2	82.9	53.0	1 - 14	77 - 347	4 - 400

(n) - Number of fish for which ages were determined, when less than total n.

* 200 = Number of fish for which weights were determined.

Table 28. Difference in mean total length between male and female fourhorn sculpin (Survey 3, 1978), tested for significance ($P \leq .05$) using Student's t-test.

Age	Mean T.L. Males	Mean T.L. Females	t value	Degrees of freedom	Significance
3	171	175	0.63	27	Not sig.
4	181	190	1.82	56	Not sig.
5	196	202	1.54	90	Not sig.
6	197	221	4.54	59	P <.001
7	206	227	2.36	29	P <.05
8	212	233	2.38	33	P <.05
9	218	230	1.30	33	Not sig.
10	219	253	1.54	10	Not sig.
11	218	253	3.06	10	P <.01

Table 29. Dry weight analysis and percent frequency of occurrence of fourhorn sculpin stomach contents.

		Number of stomachs analyzed	Notostraca	Mysidacea	Amphipoda	Cumacea	Copepoda	Isopoda	Crustacea	Pelecypoda	Coleoptera	Chironomidae	Insecta	Ascidiacea	Polychaeta	Oligochaeta	Priapulida	Nematoda	Longnose sucker	Unidentified fish	Eggs	Fourhorn sculpin	Plant material	Digested remains	Total dry weight
Richards Island Coast	Dry Weight (g)	n = 15	<0.01	<0.01	0.75	<0.01		1.64	<0.01	0.20	0.03	<0.01	<0.01	0.01	0.01	<0.01		<0.01		1.84	0.12		0.15	1.39	6.14
	% Frequency of occurrence		7	7	73	7		60	7	33	7	7	7	7	13	7		13		20	13		40	67	
Tuktoyaktuk Peninsula Bay 4 to Pelatyut Bay	Dry Weight (g)	n = 22		0.05	0.20	<0.01		6.96										<0.01	2.47	7.16	0.01		0.24	1.37	18.46
	% Frequency of occurrence			27	55	5		41										5	5	32	5		45	73	
Tuktoyaktuk Peninsula Bays 20 - 34	Dry Weight (g)	n = 27		0.11	0.86		<0.01	16.85		2.23			1.08			<0.01	0.01	0.02		2.59	1.21	0.60	0.19	2.45	28.20
	% Frequency of occurrence			37	67		4	48		7			4			7	4	15		15	4	4	63	67	

Table 30. Mean total length ($\overline{T.L.}$), standard deviation (SD), number (n) and length range of Arctic flounder caught during 1978, 1979 and 1980.

Age (yrs)		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1980	$\overline{T.L.}$							228	224	228	246	239	233	276	219	250	273		273	265	296	294	301	310	263	305		316
All	SD							8	15	19	21	25	20	21	18	-	17		42	12	-	-	-	-	-	1		-
Surveys	n							2	2	2	3	7	5	2	2	1	2		2	3	1	1	1	1	1	2		1
	max							234	234	241	262	272	266	290	232	-	284		303	279	-	-	-	-	-	305		-
	min							222	213	214	222	210	216	261	206	-	262		243	257	-	-	-	-	-	204		-
1979	$\overline{T.L.}$			88	99	156	185	201	234	246	254	266	265	272	273	300	290		280									
All	SD			4	20	10	9	20	23	22	24	18	36	20	10	-	-		-									
Surveys	n			3	3	3	8	24	28	31	27	11	4	6	3	1	1		1									
	max			92	121	165	196	238	275	281	300	294	295	292	279	-	-		-									
	min			85	85	146	167	154	189	194	207	225	214	248	261	-	-		-									
1978	$\overline{T.L.}$				138	162	166	196	218	228	243	243	247	262	281	282	279	280	263	272	277	282	264		291	286		263
All	SD				8	23	16	22	24	21	18	24	19	27	29	34	12	4	-	4	26	26	-		-	-		-
Surveys	n				2	3	32	24	60	88	50	70	16	19	9	5	3	2	-	2	9	5	1		1	1		1
	max				143	176	207	229	260	269	243	295	271	309	315	316	290	283	1	274	324	315	-		-	-		-
	min				132	135	142	158	159	158	197	198	207	212	232	231	267	277	-	269	241	250	-		-	-		-
1978	$\overline{T.L.}$				132		168	194	230	230	246	244	254	263	295	298	279	277	-	269	260	299	264		291			
Survey 2	SD				-		13	28	20	17	13	20	11	16	22	11	16	-		-	26	16	-		-			
Female	n				1		3	4	19	34	18	20	5	6	4	2	2	1		1	2	3	1		1			
	max				-		178	222	260	268	265	280	264	292	315	306	290	-		-	278	315	-		-			
	min				-		153	163	192	185	221	202	236	246	271	290	156	-		-	241	283	-		-			
1978	$\overline{T.L.}$					176	165	190	182	209	237	220	240	250	273	231			263		267	263						
Survey 2	SD					1	16	22	15	22	38	15	-	39	42	-			-		16	-						
Male	n					2	27	9	9	19	3	15	1	4	3	1			1		2	1						
	max					176	107	220	200	245	272	251	-	298	315	-			-		278	-						
	min					175	192	158	159	158	197	198	-	215	232	-			-		255	-						

Table 31. Sexual maturity analysis of Arctic flounder caught in gillnets.

Year	Survey	N	Sex(%)	Sexual Maturity				
				Immature (%)	Mature (%)	Ripe (%)	Spent (%)	Sex(%) Unknown
1980	1	44	M(75)	75	0	0	0	0
			F(25)	25	0	0	0	
	2		Not Examined					
	3		Not Examined					
1979	1	186	M(48)	48	0	0	0	<1
			F(51)	50		0	0	
	2	53	M(13)	13	0	0	0	2
			F(85)	84	0	0	0	
	3		None Caught					
1978	1	69	M(0)	0	0	0	0	0
			F(100)	100	0	0	0	
	2	272	M(45)	39	6	0	0	<1
			F(54)	34	21	0	0	
	3	138	M(37)	21	16	0	0	2
			F(61)	25	36	0	0	

Table 32. Arctic flounder, gillnet catch summary statistics, 1978, 1979 and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean T.L. (mm)	S.D. T.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range T.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island 1, 56-84	15	33	M	13.1	5.1	249.0	30.7	198.8	87.1	6 - 24	206 - 305	100 - 525
					11 (9)	F	15.2	6.7	274.7	31.4	273.6	93.0	6 - 26	222 - 316	120 - 400
					44 (41)	T	13.5	5.5	255.4	32.5	217.5	93.4	6 - 26	206 - 316	100 - 525
1979	1	28-29 June 18-20 July	Tuk. Peninsula 4, 22a, 23 31, 31a, 32	6	89 (46)	M	6.5	2.1	203.9	41.3	128.1	68.4	2 - 14	85 - 300	8 - 350
					95 (53)	F	9.3	2.3	247.5	24.0	229.5	66.0	6 - 17	187 - 293	90 - 375
					186 (101)	T	7.9	2.7	224.9	42.2	178.6	85.5	2 - 17	85 - 300	8 - 375
1978	1	26-29 June	Tuk. Peninsula 1-26	15	0	M	-	-	-	-	-	-	-	-	-
					69 (62)	F	8.4	1.9	236.0	21.2	191.8	50.3	6 - 19	190 - 295	100 - 350
					73 (65)	T	8.4	1.9	236.1	20.7	192.6	49.3	6 - 19	190 - 295	100 - 350
1980	2	01-06 Aug.	Richards Island 1, 56-84	15	-	M	Not Reported								
					-	F									
					36	T	-	-	256.4	22.3	232.9	62.9	-	205 - 307	110 - 375
1979	2	01-08 Aug.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a	6	7	M	6.4	0.8	213.3	18.5	142.0	46.9	6 - 8	188 - 238	94 - 205
					45	F	8.2	1.4	260.9	24.5	274.3	70.0	6 - 12	187 - 319	88 - 490
					69 (52)	T	7.9	1.6	243.8	39.3	235.3	90.4	3 - 12	82 - 319	7 - 490
1978	2	30 July - 05 Aug.	Tuk. Peninsula 1 to 53	38	123 (97)	M	8.0	3.3	200.5	35.9	123.6	75.5	4 - 20	136 - 315	32 - 450
					148 (127)	F	9.6	3.4	243.1	30.5	223.7	85.9	3 - 23	132 - 327	30 - 500
					275 (226)	T	8.9	3.5	222.2	41.2	176.2	96.3	3 - 23	79 - 327	6 - 500
1980	3	05-10 Sep.	Richards Island 1, 56-84	15	-	M	Not Reported								
					-	F									
					56 (34)*	T	-	-	255.4	34.1	249.5	110.7	-	167 - 324	71 - 525
1979	3	16-20 Sep.	Tuk. Peninsula 1, 4	2	0	M	None Caught								
					0	F									
					0	T									
1978	3	01-04 Sep.	Tuk. Peninsula 1 to 45	39	51 (43)	M	9.9	4.3	220.8	26.9	166.5	60.8	5 - 26	167 - 280	53 - 210
					84 (68)	F	10.2	3.0	254.5	26.6	283.7	86.3	6 - 24	185 - 324	87 - 550
					138 (113)	T	10.0	3.6	240.4	32.6	236.2	97.8	3 - 26	143 - 324	45 - 550
1980	all	01 July - 10 Sep.	Richards Island 1, 56-84	45	33 (32)	M	13.1	5.1	249.0	30.7	198.8	87.1	6 - 24	206 - 305	100 - 525
					11 (9)	F	15.2	6.7	274.7	31.4	273.6	93.0	6 - 26	222 - 316	120 - 400
					136 (41)	T	13.5	5.5	255.7	30.7	231.9	91.1	6 - 26	167 - 324	71 - 525
1979	all	28 June - 20 Sep.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a, 32	14	96 (53)	M	6.5	2.0	204.6	40.1	129.1	67.0	2 - 14	85 - 300	8 - 350
					140 (96)	F	8.8	2.0	251.8	24.9	243.9	70.3	6 - 17	187 - 319	88 - 490
					255 (153)	T	7.9	2.4	230.0	42.2	194.0	90.3	2 - 17	82 - 319	7 - 490
1978	all	26 June - 04 Sep.	Tuk. Peninsula 1 to 53	92	174 (140)	M	8.6	3.7	206.5	34.7	136.2	74.0	4 - 26	136 - 315	32 - 450
					301 (257)	F	9.5	3.1	244.6	28.3	233.1	86.0	3 - 24	132 - 327	30 - 550
					486 (404)	T	9.1	3.4	229.5	37.3	195.7	94.7	3 - 26	79 - 327	6 - 550

(n) - Number of fish for which ages were determined, when less than total n.

*Number of fish for which weights were determined = 114.

Table 33. Difference in mean total length between male and female Arctic flounder (Survey 2, 1978), tested for significance (P≤.05) using Student's t-test.

Age	Mean T.L. Males	Mean T.L. Females	t value	Degrees of Freedom	Significance
5	165	168	0.31	28	Not sig.
6	190	194	0.28	11	Not sig.
7	182	230	6.37	26	P <.001
8	209	230	3.88	51	P <.001
9	237	246	0.83	19	Not sig.
10	220	244	3.89	33	P <.001
12	250	263	0.75	8	Not sig.
13	273	295	9.91	5	Not sig.
19	267	260	0.32	2	Not sig.

Table 34. Dry weight analysis and percent frequency of occurrence of Arctic flounder stomach contents.

		Number of stomachs analyzed	Amphipoda	Cladocera	Cumacea	Ostracoda	Copepoda	Isopoda	Pelecypoda	Chironomidae	Ascidiacea	Polychaeta	Oligochaeta	Priapulida	Nematoda	Unidentified fish	Plant material	Digested remains	Total dry weight
Richards Island	Dry Weight (g)	n = 14	0.05		0.01				3.33		0.58	0.35	<0.01	0.02			0.07	1.88	6.29
	% Frequency of occurrence		57		7				79		7	14	7	14			29	36	
Tuktoyaktuk Peninsula	Dry Weight (g)	n = 87	0.19	<0.01	0.02	<0.01	<0.01	0.21	28.58	0.02	0.61	0.07	0.03	0.61	<0.01	0.01	0.97	2.85	34.17
	% Frequency of occurrence		31	1	3	1	1	10	54	2	7	6	29	29	2	1	61	45	

Table 35. Sexual maturity analysis of starry flounder caught in gillnets.

Year	Survey	N	Sex(%)	Sexual Maturity				
				Immature (%)	Mature (%)	Ripe (%)	Spent (%)	Sex(%) Unknown
1980	1	9	M(56)	11	22	22	0	0
			F(44)	11	22	11	0	
	2	2	M	Insufficient Sample Examined				
			F					
	3	1	M	Insufficient Sample Examined				
			F					
1979	1	39	M(72)	72	0	0	0	0
			F(28)	28	0	0	0	
	2	25	M(48)	48	0	0	0	4
			F(48)	48	0	0	0	
	3	2	M	Insufficient Sample Examined				
			F					
1978	1	33	M(57)	0	12	39	6	0
			F(42)	3	21	18	0	
	2	72	M(57)	53	1		3	1
			F(41)	33	8			
	3	20	M(40)	20	0	0	0	0
			F(60)	35	25	0	0	

Table 36. Starry flounder gillnet catch summary statistics, 1978, 1979 and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean T.L. (mm)	S.D. T.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range T.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island 1, 56-84	15	5	M	16.2	3.2	278.6	30.7	250.0	75.0	12 - 20	224 - 297	125 - 325
					4	F	-	-	281.0	48.0	325.0	164.6	-	214 - 325	125 - 525
					9 (6)	T	15.5	3.3	279.7	36.6	283.3	120.5	12 - 20	214 - 325	125 - 525
1979	1	28-29 June 18-20 July	Tuk. Peninsula 4, 22a, 23 31, 31a, 32	6	28 (13)	M	19.6	4.5	246.7	34.3	200.0	78.9	10 - 26	163 - 315	60 - 425
					11 (9)	F	23.1	5.1	285.6	23.4	350.0	73.3	10 - 27	221 - 305	150 - 400
					39 (22)	T	21.0	4.9	257.7	36.0	242.3	102.5	10 - 27	163 - 315	60 - 425
1978	1	26-29 June	Tuk. Peninsula 1-26	15	19	M	-	-	251.6	23.7	199.5	53.5	-	215 - 316	125 - 325
					14	F	-	-	272.1	36.4	285.7	112.5	-	209 - 331	125 - 525
					34	T	-	-	259.1	31.3	233.5	92.7	-	209 - 331	125 - 525
1980	2	01-06 Aug.	Richards Island 1, 56-84	15	1	M	-	-	284.0	-	300.0	-	-	-	-
					1	F	20.0	-	329.0	-	575.0	-	-	-	-
					4 (1)	T	20.0	-	296.3	27.2	393.8	147.7	-	266 - 329	250 - 575
1979	2	01-07 Aug.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a	6	12 (11)	M	19.2	7.3	250.6	24.5	207.1	52.0	6 - 27	195 - 278	95 - 250
					12 (11)	F	17.0	6.0	278.8	28.0	328.3	128.0	9 - 26	244 - 328	180 - 550
					44 (25)	T	17.2	6.9	256.5	30.0	242.7	95.5	4 - 27	152 - 328	53 - 550
1978	2	30 July - 05 Aug.	Tuk. Peninsula 1 to 53	38	41 (34)	M	16.3	7.1	247.1	27.8	206.2	79.0	5 - 27	185 - 337	90 - 500
					30 (23)	F	15.8	6.3	266.1	31.8	265.6	101.8	6 - 26	206 - 329	115 - 465
					72 (58)	T	15.9	6.7	255.5	30.8	231.6	92.8	4 - 27	185 - 337	90 - 500
1980	3	05-10 Sep.	Richards Island 1, 56-84	15	0	M	-	-	-	-	-	-	-	-	-
					0	F	-	-	-	-	-	-	-	-	-
					1	T	-	-	243.0	-	175.0	-	-	-	-
1979	3	16-20 Sep.	Tuk. Peninsula 1, 4	2	2	M	-	-	279.5	-	305.0	-	-	259 - 300	250 - 360
					0	F	-	-	-	-	-	-	-	-	-
					2	T	-	-	279.5	-	305.0	-	-	259 - 300	250 - 360
1978	3	01-04 Sep.	Tuk. Peninsula 1 to 45	39	8 (5)	M	15.8	7.5	242.6	21.6	216.3	52.4	7 - 24	210 - 268	130 - 275
					12 (11)	F	16.7	6.6	271.9	28.4	311.7	126.5	9 - 26	255 - 328	165 - 575
					20 (16)	T	16.4	6.6	260.2	29.3	273.5	112.2	7 - 26	210 - 328	130 - 575
1980	all	01 July - 10 Sep.	Richards Island 1, 56-84	45	6 (5)	M	16.2	3.2	279.5	27.6	258.3	70.1	12 - 20	224 - 297	125 - 325
					5	F	16.0	-	290.6	46.9	375.0	181.1	12 - 20	214 - 329	125 - 575
					14 (7)	T	16.1	3.5	281.8	34.4	307.1	134.2	12 - 20	214 - 329	125 - 575
1979	all	28 June - 20 Sep.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a, 32	14	42 (24)	M	19.4	5.8	249.4	31.7	207.0	74.0	6 - 27	163 - 315	60 - 425
					23 (20)	F	19.8	6.3	282.0	25.6	338.7	103.7	9 - 27	221 - 328	150 - 550
					85 (47)	T	19.0	6.3	257.6	32.7	244.0	97.9	4 - 27	152 - 328	53 - 550
1978	all	26 June - 04 Sep.	Tuk. Peninsula 1 to 53	92	68 (40)	M	16.0	7.1	247.8	25.9	205.5	69.4	5 - 27	185 - 337	90 - 500
					56 (34)	F	16.1	6.3	268.8	31.9	280.5	109.6	6 - 26	206 - 331	115 - 575
					126 (75)	T	16.4	6.7	257.2	30.5	238.8	96.5	5 - 27	185 - 337	90 - 575

(n) - Number of fish for which ages were determined, when less than total n.

Table 37. Mean total length statistics ($\overline{T.L.}$), standard deviation (SD), number and length range of starry flounder caught during 1978 and 1979.

		Age (yrs)																							
		4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1979 All Surveys	$\overline{T.L.}$	152		195			244	212	238	251	281	248	259		261	263	257	259	256	287	276	282	293	296	273
	SD	-		-			-	13	-	23	18	-	12		39	-	-	2	7	28	25	17	17	29	20
	n	1		1			1	2	1	4	2	1	2		4	1	1	3	2	3	2	5	3	4	4
	max	-		-			-	221	-	271	293	-	267		315	-	-	261	261	315	294	298	305	328	295
	min	-		-			-	202	-	229	268	-	250		224	-	-	257	251	259	288	259	274	260	247
1978 All Surveys	$\overline{T.L.}$		185	207	234	235	239	225	238	240		296		278	259	271	265	288	275	271	275	267	309	291	257
	SD		-	2	16	-	13	13	16	20		-		17	4	15	27	34	21	11	33	21	7	33	-
	n		1	4	4	1	7	5	3	4		1		3	2	5	3	7	6	3	2	6	3	4	1
	max		-	209	249	-	262	246	248	267		-		293	262	296	296	329	304	283	298	294	316	337	-
	min		-	204	220	-	225	214	219	221		-		260	256	256	248	247	256	264	251	242	302	258	-

Table 38. Dry weight analysis and percent frequency of occurrence of starry flounder stomach contents.

		Number of stomachs analyzed	Mysidacea	Amphipoda	Cumacea	Isopoda	Pelecypoda	Polychaeta	Oligochaeta	Priapulida	Nematoda	Unidentified fish	Plant material	Digested remains	Total dry weight
Tuktoyaktuk Peninsula Bay 21 to Bay 33	Dry Weight (g)	N = 51	0.01	1.63	<0.01	0.81	34.77	4.28	0.01	0.14	0.01	0.32	2.55	10.45	54.98
	% Frequency of occurrence		8	45	2	25	61	10	6	24	18	6	59	43	
Tuktoyaktuk Peninsula Bay 1 and 3	Dry Weight (g)	N = 6	0.01	<0.01		0.46	0.03		<0.01	<0.01	<0.01		<0.01	0.74	1.24
	% Frequency of occurrence		33	17		83	17		17	17	17		33	100	

Table 39. Sexual maturity analysis of Pacific herring caught in gillnets.

Year	Survey	N	Sex(%)	Sexual Maturity					
				Immature (%)	Maturing (%)	Mature (%)	Ripe (%)	Spent (%)	Sex(%) Unknown
1980	1	13	M(61)	0	15	0	0	46	0
			F(38)	0	0	0	0	38	
	2	12	M(25)	17	8	0	0	0	17
			F(58)	58	0	0	0	0	
	3	45	M(46)	0	33	13	0	0	13
			F(40)	2	38	0	0	0	
1979	2	17	M(53)	6	47	0	0	0	6
			F(42)	18	18	0	0	0	
1978	1	3	M(0)	0	0	0	0	0	0
			F(100)	0	0	33	67	0	
	2	26	M(55)	0	41	10	4	0	0
			F(45)	17	24	4	0	0	
	3	40	M(53)	0	5	48	0	0	5
			F(44)	3	18	23	0	0	

Table 40. Pacific herring, gillnet catch summary statistics, 1978, 1979 and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range F.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island 1, 56-84	15	8	M	9.0	2.3	307.1	12.9	280.0	26.6	7 - 13	290 - 326	250 - 320
					5 (3)	F	9.0	1.0	303.2	22.4	283.0	87.2	8 - 10	274 - 327	185 - 375
					13 (10)	T	9.0	1.9	305.6	16.4	281.2	54.3	7 - 13	274 - 327	185 - 375
1979	1	28-29 June	Tuk. Peninsula		1	M	10.0	-	283.0	-	240.0	-	-	-	-
		18-20 July	4, 22a, 23	6	1	F	19.0	-	299.0	-	275.0	-	-	-	-
			31, 31a, 32		2	T	14.5	-	291.0	-	257.5	-	10 - 19	283 - 299	240 - 275
1978	1	26-29 June	Tuk. Peninsula		0	M	-	-	-	-	-	-	-	-	-
			1-26	15	3	F	9.3	1.5	291.3	22.1	291.7	38.2	8 - 11	268 - 312	250 - 325
					3	T	9.3	1.5	291.3	22.1	291.7	38.2	8 - 11	268 - 312	250 - 325
1980	2	01-06 Aug.	Richards Island		3 (2)	M	8.5	4.9							
			1, 56-84	15	7 (4)	F	3.0	0.0	200.0	48.6	86.4	83.3	3 - 3	175 - 310	50 - 275
					12 (8)	T	4.4	3.2	197.0	54.8	87.5	87.5	2 - 12	108 - 310	10 - 275
1979	2	01-07 Aug.	Tuk. Peninsula		9	M	7.3	3.0	254.8	57.6	204.1	135.2	3 - 10	175 - 318	48 - 400
			1, 4, 22a,	6	7 (5)	F	5.8	2.8	240.3	47.1	171.1	89.8	3 - 9	174 - 285	46 - 250
			23, 31, 31a		17 (14)	T	6.8	2.9	240.0	61.3	179.2	119.5	3 - 10	105 - 318	12 - 400
1978	2	30 July -	Tuk. Peninsula		16 (13)	M	9.2	2.0	296.8	22.3	296.3	77.3	7 - 15	256 - 334	165 - 450
		05 Aug.	I to 53	38	13 (11)	F	10.4	2.5	300.5	19.6	314.0	76.6	6 - 15	256 - 317	150 - 450
					30 (24)	T	9.7	2.3	291.4	43.9	294.2	92.7	6 - 15	86 - 334	5 - 450
1980	3	05-10 Sep.	Richards Island		21 (15)	M	10.7	1.8	297.3	11.9	312.0	38.7	8 - 15	268 - 314	260 - 405
			1, 56-84	15	18 (9)	F	11.4	1.7	294.6	31.2	304.6	94.3	9 - 14	201 - 329	71 - 475
					46 (27)	T	10.1	3.1	270.7	64.6	264.6	122.9	1 - 15	113 - 329	11 - 475
1979	3	16-20 Sep.	Tuk. Peninsula		0	M)									
			I, 4	2	0	F)			NO CATCH						
					0	T)									
1978	3	01-04 Sep.	Tuk. Peninsula		21 (15)	M	10.1	1.9	290.7	17.7	295.7	58.3	7 - 14	262 - 318	170 - 400
			1 to 45	39	17 (11)	F	10.9	2.9	300.0	26.3	322.9	70.9	7 - 17	260 - 343	190 - 400
					40 (26)	T	10.4	2.4	285.1	48.2	292.8	91.6	7 - 17	95 - 343	6 - 400
1980	all	01 July -	Richards Island		32 (24)	M	10.0	2.3	293.1	29.8	286.8	70.5	5 - 15	180 - 326	55 - 405
		10 Sep.	1, 56-84	45	30 (16)	F	8.9	3.8	274.0	53.5	250.1	127.2	3 - 14	175 - 329	50 - 475
					71 (45)	T	8.8	3.6	264.6	65.7	237.7	126.9	1 - 15	108 - 329	10 - 475
1979	all	28 June -	Tuk. Peninsula		10	M	7.6	2.9	257.6	55.0	207.7	128.0	3 - 10	175 - 318	48 - 400
		20 Sep.	1, 4, 22a, 23,	14	8 (6)	F	8.0	5.9	247.6	48.3	184.1	90.9	3 - 19	174 - 299	46 - 275
			31, 31a, 32		19 (16)	T	7.8	4.1	245.4	60.0	187.5	115.5	3 - 19	105 - 318	12 - 400
1978	all	26 June -	Tuk. Peninsula		37 (28)	M	9.6	2.0	293.4	19.8	295.9	66.2	7 - 15	256 - 334	165 - 450
		04 Sep.	1 to 53	92	33 (25)	F	10.5	2.6	299.4	22.9	316.6	69.9	6 - 17	256 - 343	150 - 450
					73 (53)	T	10.0	2.3	287.9	45.4	293.4	89.7	6 - 17	86 - 343	5 - 450

(n) - Number of fish for which ages were determined, when less than total n.

Table 41. Mean fork length ($\overline{F.L.}$), standard deviation (SD), number (n) and length range of Pacific herring caught during 1978 and 1980.

		Age (yrs)																	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19
1980	$\overline{F.L.}$		120	108	171	178	189		310	305	301	305	291	305	302	298	311			
All	SD		-	-	25	-	16		2	23	11	15	12	14	12	-	-			
Surveys	n		1	1	5	1	2		3	2	8	4	7	6	3	1	1			
	max		-	-	185	-	200		312	321	321	327	301	329	316	-	-			
	min		-	-	126	-	178		309	288	287	294	268	293	294	-	-			
1978 & 1979	$\overline{F.L.}$				176			233	272	281	308	299	297	304	296	318	313		335	299
All	SD				1.5			21	22	19	16	17	15	11	11	5	1		-	-
Surveys	n				4			4	3	14	6	22	5	2	2	3	2		1	1
	max				177			256	297	312	334	322	310	312	304	323	313		-	-
	min				174			205	256	260	285	266	273	296	288	314	312		-	-

Table 42. Dry weight analysis and percent frequency of occurrence of Pacific herring stomach contents.

		Number of stomachs analyzed	Mysidacea	Amphipoda	Copepoda	Acarina	Pelecypoda	Chironomidae	Insecta	Nematoda	Foraminifera	Plant material	Digested remains	Total dry weight
Tuktoyaktuk Peninsula Coast	Dry Weight (g)	N = 10	0.01	<0.01	0.34	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.02	0.77	1.16
	% Frequency of occurrence		20	10	30	20	20	20	10	20	10	60	70	

Table 43. Sexual maturity analysis of saffron cod caught in gillnets.

Year	Survey	N	Sex(%)	Sexual Maturity				
				Immature (%)	Mature (%)	Ripe (%)	Spent (%)	Sex(%) Unknown
1980	1	9	M(67)	67	0	0	0	0
			F(33)	33	0	0	0	
	2	22	M(54)	54	0	0	0	0
			F(46)	41	0	0	5	
	3	21	M(86)	86	0	0	0	0
			F(14)	14	0	0	0	
1979	1	4	M(25)	Insufficient Sample				
			F(75)					
	2	12	M(50)	17	33	0	0	17
			F(33)	33	0	0	0	
	3	6	M(33)	Insufficient Sample				
			F(67)					
1978	1	1	M(100)	Insufficient Sample				
			F(0)					
	2	63	M(49)	47	2	0	0	10
			F(40)	37	3	0	0	
	3	52	M(31)	12	19	0	0	1.9
			F(67)	50	17	0	0	

Table 44. Saffron cod gillnet catch summary statistics, 1978, 1979, and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range F.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island		6	M	11.0	1.5	428.5	23.7	568.3	81.0	9 - 13	395 - 455	450 - 675
			1, 56-84	15	3	F	12.0	2.6	436.0	27.0	613.3	180.4	9 - 14	409 - 463	440 - 800
					9	F	11.3	1.9	431.0	23.4	583.3	112.9	9 - 14	390 - 463	440 - 800
1979	1	28-29 June	Tuk. Peninsula		1	M	10.0	-	431.0	-	625.0	-	-	-	-
		18-20 July	4, 22a, 23	6	3	F	8.3	1.5	393.0	40.7	435.0	135.4	7 - 10	368 - 440	340 - 590
			31, 31a, 32		5 (4)*	T	8.8	1.5	349.8	122.4	389.6	243.1	7 - 10	139 - 440	18 - 625
1978	1	26-29 June	Tuk. Peninsula		1	M	10.0	-	384.0	-	450.0	-	-	-	-
			1-26	15	0	F	-	-	-	-	-	-	-	-	-
					1	T	10.0	-	384.0	-	450.0	-	-	-	-
1980	2	01-06 Aug.	Richards Island		12	M	10.4	2.9	412.1	13.8	531.3	65.0	6 - 14	387 - 433	400 - 600
			1, 56-84	15	10	F	11.4	3.6	420.5	18.7	535.0	69.9	7 - 19	385 - 448	400 - 650
					22	T	10.9	3.2	415.9	16.4	532.9	65.6	6 - 19	385 - 448	400 - 650
1979	2	01-07 Aug.	Tuk. Peninsula		6	M	8.7	2.4	381.5	49.8	470.0	167.5	6 - 12	320 - 451	275 - 700
			1, 4, 22a,	6	4	F	9.5	1.0	395.8	25.7	512.5	103.1	8 - 10	366 - 428	400 - 650
			23, 31, 31a		12	T	8.1	2.8	350.3	93.8	411.3	217.6	3 - 12	163 - 451	30 - 700
1978	2	30 July -	Tuk. Peninsula		31 (20)	M	11.3	1.7							
		05 Aug.	1-53	38	26 (17)	F	9.3	2.2	384.7	34.4	457.1	124.3	5 - 13	304 - 454	200 - 750
					64 (40)	T	10.7	2.0	383.3	49.0	460.3	132.4	5 - 14	111 - 499	9 - 750
1980	3	05-10 Sep.	Richards Island		18	M	11.4	2.3	417.5	34.7	645.8	177.5	6 - 15	322 - 473	275 - 1000
			1, 56-84	15	3	F	7.0	0	422.3	25.0	588.3	113.1	7 - 7	395 - 444	425 - 650
					21	T	10.7	2.7	418.2	33.0	633.3	170.7	6 - 15	322 - 473	275 - 1000
1979	3	16-20 Sep.	Tuk. Peninsula		0	M									
			1, 4	2	0	F					NONE CAUGHT				
					0	T									
1978	3	01-04 Sep.	Tuk. Peninsula		16 (10)	M	9.8	2.0	380.8	48.1	488.1	156.8	7 - 13	306 - 460	250 - 650
			1-45	39	35 (19)	F	11.0	3.2	386.5	46.9	493.6	191.6	6 - 16	308 - 472	245 - 810
					52 (29)	T	10.6	2.9	379.2	60.9	482.6	190.3	6 - 16	100 - 472	8 - 810
1980	all	01 July -	Richards Island		36 (34)	M	11.0	2.4	417.5	27.5	594.7	142.8	6 - 15	322 - 473	275 - 1000
		10 Sep.	1, 56-84	45	16	F	10.7	3.5	423.8	20.7	554.1	100.4	7 - 19	385 - 463	400 - 800
					52 (50)	T	10.9	2.8	419.4	25.6	582.2	131.6	6 - 19	322 - 473	275 - 1000
1979	all	28 June -	Tuk. Peninsula		7	M	8.9	2.3	388.6	49.2	492.1	163.8	6 - 12	320 - 451	275 - 700
		20 Sep.	1, 4, 22a, 23,	14	7	F	9.0	1.3	394.6	29.8	479.3	114.6	7 - 10	366 - 440	340 - 650
			31, 31a, 32		17	T	8.3	2.5	350.1	99.0	404.9	217.8	3 - 12	139 - 451	18 - 700
1978	all	26 June -	Tuk. Peninsula		48 (31)	M	10.8	1.9	386.6	40.8	477.6	132.8	7 - 14	306 - 409	200 - 730
		04 Sep.	1-53	92	61 (36)	F	10.4	2.8	385.7	41.7	478.0	166.1	5 - 16	304 - 472	200 - 810
					117 (70)	T	10.6	2.4	381.5	54.2	470.1	159.9	5 - 16	100 - 499	8 - 810

*(n) - Number of fish for which ages were determined, when less than total n.

Table 45. Mean fork length ($\overline{F.L.}$), standard deviation (SD), number (n) and length range of saffron cod caught during 1978, 1979 and 1980.

		Age (yrs)														
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1980	$\overline{F.L.}$		365	409	387	416	418	419	430	423	431	473				420
All	SD		60	21	11	15	19	25	18	22	15	-				-
Surveys	n		2	8	2	3	4	6	10	9	4	-				1
	max		407	444	395	434	432	451	464	463	448	-				-
	min		322	385	379	406	390	379	404	401	412	-				-
1978	$\overline{F.L.}$	334	328	345	384	384	398	404	413	403	409	455				
All	SD	-	21	54	37	40	40	38	31	38	26	-				
Surveys	n	1	3	2	7	10	7	17	8	7	5	1				
	max	-	350	383	413	431	433	499	454	460	435	-				
	min	-	308	306	312	315	320	316	361	357	370	-				

	Fork Length (mm) at Age (yrs)									
	3	4	5	6	7	8	9	10	11	12
1979	168	163		336	368	371		440		451
All				320		366		431		
Surveys						365		428		
								409		
								408		
								400		
								389		

Table 46. Dry weight analysis and percent frequency of occurrence of saffron cod stomach contents.

		Number of stomachs analyzed	Mysidacea	Amphipoda	Cladocera	Cumacea	Isopoda	Crustacea	Pelecypoda	Chironomidae	Insecta	Polychaeta	Oligochaeta	Priapulida	Nematoda	Fourhorn sculpin	Eggs	Unidentified fish	Plant material	Digested remains	Total dry weight
Richards Island	Dry Weight (g)	n = 26	0.41	1.62	<0.01	0.01	1.56	0.01	0.20	<0.01	<0.01	1.31	<0.01	0.05	0.01	0.30	0.72	3.27	0.35	4.04	13.85
	% Frequency of occurrence		46	92	4	4	54	12	27	4	4	31	4	35	15	4	4	20	81	92	
Tuktoyaktuk Peninsula Bays 3 - 16	Dry Weight (g)	n = 20	0.09	2.06			1.33		<0.01				<0.01	0.06	0.03			0.49	0.18	3.83	8.07
	% Frequency of occurrence		40	80			45		5				5	20	35			25	55	85	
Tuktoyaktuk Peninsula Bays 21 - 50	Dry Weight (g)	n = 26	0.42	2.85		0.05	0.80		0.06	<0.01			0.01	0.11				0.37	0.24	1.46	6.37
	% Frequency of occurrence		58	81		12	50		8	4			15	15				38	69	54	

Table 47. Arctic cisco gillnet catch summary statistics, 1978, 1979, and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range F.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island		19	M	6.9	1.5	326.3	37.7	371.7	109.6	4 - 10	199 - 373	62 - 550
			1, 56-84	15	11	F	7.5	1.9	343.0	51.4	447.7	161.6	3 - 10	200 - 380	65 - 650
					31	T	7.0	1.9	325.8	56.0	387.1	148.6	1 - 10	129 - 380	12 - 650
1979	1	28-29 June	Tuk. Peninsula		34	M	4.9	1.2	252.6	32.1	155.0	81.6	3 - 8	201 - 353	50 - 500
		18-20 July	4, 22a, 23	6	9	F	5.9	1.6	299.3	54.7	303.9	223.6	4 - 9	231 - 397	100 - 775
			31, 31a, 32		43	T	5.1	1.2	262.3	42.0	186.2	120.7	3 - 9	201 - 397	50 - 775
1978	1	26-29 June	Tuk. Peninsula		14	M	6.6	1.5	333.4	42.6	437.5	140.7	5 - 10	235 - 407	150 - 650
			1-26	15	23	F	7.2	1.6	360.7	55.2	587.6	224.9	3 - 10	156 - 447	40 - 1150
					38	T	6.9	1.5	348.7	52.2	524.7	209.1	3 - 10	156 - 447	40 - 1150
1980	2	01-06 Aug.	Richards Island		18	M	5.2	1.9	308.4	70.1	380.3	197.2	1 - 9	109 - 378	10 - 675
			1, 56-84	15	6	F	5.0	1.4	320.3	51.9	390.8	199.1	3 - 7	245 - 377	125 - 650
					30	T	4.7	1.9	380.3	91.2	317.5	220.1	1 - 9	101 - 378	5 - 675
1979	2	01-07 Aug.	Tuk. Peninsula		19	M	8.0	0.9	328.6	25.2	436.6	108.6	7 - 10	286 - 373	270 - 625
			1, 4, 22a,	6	8	F	7.5	1.2	339.0	36.0	491.9	191.5	6 - 9	287 - 395	265 - 850
			23, 31, 31a		28	T	7.7	1.2	326.8	37.9	439.3	152.4	4 - 10	196 - 395	70 - 850
1978	2	30 July -	Tuk. Peninsula		61	M	5.4	1.2	290.9	49.4	301.9	142.9	3 - 9	180 - 368	50 - 570
		05 Aug.	1 to 53	38	38	F	6.1	1.6	316.7	46.8	384.7	165.9	3 - 9	198 - 414	80 - 860
					103	T	5.6	1.5	296.3	53.8	322.8	162.9	3 - 9	170 - 444	43 - 860
1980	3	05-10 Sep.	Richards Island		21	M	3.9	1.8	242.9	67.0	193.2	178.9	2 - 8	105 - 368	7 - 653
			1, 56-84	15	16	F	4.5	1.8	275.0	39.1	288.8	231.3	2 - 9	108 - 405	7 - 750
					47	T	3.6	1.9	232.2	85.4	190.7	201.3	1 - 9	105 - 405	7 - 750
1979	3	16-20 Sep.	Tuk. Peninsula		13	M	7.2	1.0	334.2	47.9	461.9	172.2	6 - 9	201 - 391	90 - 750
			1, 4	2	5	F	8.2	0.4	386.0	17.8	702.0	147.2	8 - 9	364 - 405	550 - 920
					18	T	7.5	1.0	348.6	47.6	528.6	195.6	6 - 9	201 - 405	90 - 920
1978	3	01-04 Sep.	Tuk. Peninsula		137	M	5.9	1.2	302.7	48.4	330.5	153.0	3 - 8	181 - 398	50 - 760
			1 to 45	39	153	F	6.1	1.4	313.6	57.4	382.6	200.0	2 - 10	169 - 432	40 - 1200
					329	T	5.7	1.6	294.4	63.9	323.8	194.3	1 - 10	115 - 432	15 - 1200
1980	all	01 July -	Richards Island		58	M	5.3	2.1	290.5	69.7	309.7	185.7	1 - 10	105 - 378	7 - 675
		10 Sep.	1, 56-84	45	33	F	5.6	2.2	305.9	77.2	360.3	211.7	2 - 10	108 - 405	7 - 750
					108	T	4.9	2.4	272.4	88.5	282.3	209.6	1 - 10	101 - 405	5 - 750
1979	all	28 June -	Tuk. Peninsula		66	M	6.2	1.8	290.5	52.0	295.5	183.6	3 - 10	201 - 391	50 - 750
		20 Sep.	1, 4, 22a, 23,	14	22	F	7.0	1.5	333.5	52.9	462.7	245.3	4 - 9	231 - 405	100 - 920
			31, 31a, 32		89	T	6.4	1.7	300.1	55.7	335.1	183.6	3 - 10	196 - 405	50 - 920
1978	all	26 June -	Tuk. Peninsula		212	M	5.8	1.3	301.3	49.2	329.3	152.0	3 - 10	180 - 407	50 - 760
		04 Sep.	1 to 53	92	214	F	6.2	1.5	319.2	57.1	405.3	206.4	2 - 10	156 - 447	40 - 1200
					470	T	5.8	1.6	299.2	62.6	340.1	196.6	1 - 10	115 - 447	15 - 1200

Table 48. Mean fork length ($\overline{F.L.}$), standard deviation (SD), number (n) and length range of Arctic cisco caught during 1978, 1979, and 1980.

Age (yrs)		0	1	2	3	4	5	6	7	8	9	10
1980	$\overline{F.L.}$		116	163	222	274	332	339	354	340	370	367
All surveys	SD		11	36	31	33		24	20	22	23	19
	n		7	14	15	13	15	14	14	8	6	2
	max		133	203	275	311	375	379	378	373	405	380
	min		105	101	176	199	269	296	325	307	335	353
1979	$\overline{F.L.}$				204	227	260	289	325	351	370	368
All surveys	SD				7	17	10	19	25	30	24	-
	n				5	15	11	17	16	14	11	1
	max				214	254	273	332	357	405	397	-
	min				195	196	241	259	286	307	327	-
1978	$\overline{F.L.}$		92	148	186	220	287	319	343	360	393	410
All surveys	SD		11	34	19	23	30	23	22	19	42	10
	n		47	10	44	55	83	114	113	39	8	5
	max		131	184	223	302	352	384	396	404	447	420
	min		72	96	130	169	216	244	292	323	323	396
1978	$\overline{F.L.}$			175	192	226	287	324	349	362	401	410
3rd survey	SD			2	20	31	31	25	21	19	40	12
(Females)	n			2	9	16	34	53	62	26	7	4
	max			176	223	302	352	384	396	404	447	420
	min			173	156	169	216	272	292	323	323	396
1978	$\overline{F.L.}$				194	221	288	315	336	357	342	407
3rd survey	SD				14	20	31	22	21	20	-	-
(Males)	n				8	26	49	60	50	13	1	1
	max				223	283	340	366	392	398	-	-
	min				180	198	226	244	303	326	-	-

Table 49. Sexual maturity analysis of Arctic cisco caught in gillnets.

Year	Survey	N	Sex (%)	Sexual Maturity			Sex Unknown %
				Immature %	Mature %	Spent %	
1980	1	30	M(63.3)	63.3	0	0	0
			F(36.7)	33.3	3.3	0	
	2	27	M(77.7)	77.7	0	0	0
			F(22.3)	11.1	11.1	0	
	3	37	M(56.7)	56.7	0	0	0
			F(43.3)	43.3	0	0	
1979	1	43	M(79.1)	79.1	0	0	0
			F(20.9)	18.6	2.3	0	
	2	28	M(67.9)	67.9	0	0	3.5
			F(28.6)	25.0	3.6	0	
	3	18	M(72.2)	22.3	44.4	5.5	0
			F(27.8)	5.5	22.2	0	
1978	1	41	M(34.2)	34.2	0	0	4.8
			F(61.0)	48.8	12.2	0	
	2	103	M(59.2)	57.3	1.9	0	4.0
			F(36.8)	35.8	1.0	0	
	3	329	M(41.6)	41.6	0	0	11.9
			F(46.5)	41.6	4.9	0	

Table 50. Difference in mean fork length between male and female Arctic cisco from Survey 3, 1978, tested for significance (P≤.05) using Student's t-test.

Age	Males				Females				t test	Significance
	n	$\overline{F.L.}$	SD	Range	n	$\overline{F.L.}$	SD	Range		
1	0				0					
2	0				2	174.5	2.1	178 - 176	-	
3	8	193.8	14.4	180 - 223	9	191.6	19.8	156 - 223	-	Not sig.
4	26	221.0	20.3	198 - 283	16	226.1	31.2	169 - 302	0.6433	Not sig.
5	49	287.6	30.5	226 - 340	34	287.1	30.9	216 - 352	-	Not sig.
6	60	316.0	21.6	244 - 366	53	323.9	24.8	272 - 384	1.8100	p <.05
7	50	336.3	20.5	303 - 392	62	349.2	21.4	292 - 396	3.2312	p <.01
8	13	357.1	20.1	326 - 389	26	362.2	18.5	323 - 404	0.7888	Not sig.
9	1	342.0	-	-	7	400.7	39.6	323 - 447	-	Not sig.
10	1	407.0	-	-	4	410.2	11.8	396 - 420		Not sig.

Table 51. Dry weight analysis and percent frequency of occurrence of Arctic cisco stomach contents.

		Number of stomachs analyzed	Acarina	Mysidacea	Amphipoda	Cladocera	Ostracoda	Copepoda	Isopoda	Gastropoda	Pelecypoda	Coleoptera	Trichoptera	Unidentified remains	Chironomidae	Insect remains	Asciidacea	Polychaeta	Oligochaeta	Hirundinea	Priapulidae	Nematoda	Fish Eggs	Unidentified fish remains	Plant remains	Digested remains	Total dry weight (g)
Richards Island	Dry Weight in Stomachs (g)	N = 17	-	1.71	0.61	<0.01	<0.01	<0.01	-	<0.01	0.43	<0.01	-	<0.01	<0.01	0.02	0.59	0.16	-	-	<0.01	-	<0.01	0.18	<0.01	1.55	5.27
	% Frequency in Stomachs		-	12.5	37.5	6.2	6.2	6.2	-	6.2	37.5	6.2	-	6.2	6.2	25.0	12.5	43.8	-	-	6.2	-	6.2	6.2	25.0	75.0	
Tuktoyaktuk Peninsula (East Channel to Pelly Bay)	Dry Weight in Stomachs (g)	N = 29	-	-	-	<0.01	-	0.15	-	-	0.02	-	-	-	-	<0.01	-	-	-	-	-	-	-	0.05	0.04	0.34	0.61
	% Frequency in Stomachs		-	-	-	6.7	-	33.3	-	-	6.7	-	-	-	-	13.3	-	-	-	-	-	-	-	6.7	20.0	33.3	
Tuktoyaktuk Peninsula (Hutchison Bay to Liverpool Bay)	Dry Weight in Stomachs (g)	N = 54	<0.01	0.15	0.28	<0.01	<0.01	3.70	<0.01	-	0.02	-	<0.01	-	-	0.03	-	<0.01	0.02	<0.01	-	<0.01	-	0.55	0.13	1.79	6.68
	% Frequency in Stomachs		1.8	29.1	21.8	1.8	1.8	27.3	1.8	-	1.8	-	1.8	-	-	7.3	-	1.8	1.8	1.8	-	1.8	-	5.5	38.2	50.9	

Table 52. Length-weight analysis of least cisco from various regions of the Beaufort Coast. Calculated weights are based on the equation Log W = B log L + A. (W = weight, L = fork length)

	Sex	N	Slope(B)	Y-intercept(A)	r^2	Calculated weight(g) 250 mm	300 mm
Richards Island Lakes 1980	F	35	3.1939	-5.4706	0.9345	154	276
	M	36	3.3448	-5.7921	0.9861	169	311
Tuktoyaktuk Pen. Lakes 1979	F	47	3.0380	-5.0496	0.9468	171.	299
	M	33	3.0145	-5.0289	0.9171	158	274
Canyanek Lakes 1978	F	51	2.8918	-4.6314	0.8221	201	340
	M	24	3.3095	-5.6969	0.9631	173	317
Richards Island Coast 1980	F	54	3.1334	-5.3643	0.9482	141	249
	M	51	3.1388	-5.3751	0.9425	142	251
Tuk. Pen. Coast 1979	F	32	3.0327	-5.1011	0.8284	148	258
	M	28	3.4324	-6.1000	0.9127	135	253
Tuk. Pen. Coast 1978	F	142	3.5619	-6.3856	0.9466	143	274
	M	115	3.4798	-6.1863	0.9225	144	271
Lakes - all years combined	F	134	3.2878	-5.6583	0.9429	168	306
	M	98	3.2525	-5.5827	0.9721	165	298
Coast - all years combined	F	228	3.3462	-5.8672	0.9247	143	264
	M	193	3.3567	-5.8972	0.9233	142	262
From Mann, 1974 'Brackish water'	F	35	1.7744	-2.1115	0.8198	139	192
	M	35	2.9477	-4.9518	0.9864	131	224
From Mann, 1974 Peter Lake "normal" - sexes combined		50	2.5636	-3.9616	0.9320	153	-
From Mann, 1974 Trout Lake "normal" - sexes combined		100	3.0955	-5.2447	0.9946	151	265

Table 53. Sexual maturity analysis of least cisco caught in gillnets at coastal locations.

Year	Survey	N	Sex(%)	Maturity State (%)				
				Non Spawners	Mature	Ripe	Spent	Sex Unknown
1980 (Coastal)	1	45	M(45)	45	0	0	0	9
			F(46)	44	2	0	0	
	2	41	M(30)	30	0	0	0	18
			F(52)	42	10	0	0	
	3	42	M(45)	40	5	0	0	24
			F(31)	24	7	0	0	
1979 (Coastal)	1	32	M(37)	37	0	0	0	19
			F(44)	38	6	0	0	
	2	19	M(47)	47	0	0	0	5
			F(47)	42	5	0	0	
	3	23	M(30)	17	13	0	0	30
			F(39)	30	9	0	0	
1978 (Coastal)	1	100	M(33)	33	0	0	0	3
			F(64)	63	1	0	0	
	2	93	M(48)	48	0	0	0	5
			F(46)	45	1	0	0	
	3	76	M(49)	49	0	0	0	1
			F(50)	41	8	1	0	

Table 54. Sexual maturity analysis of least cisco caught in gillnets at freshwater locations.

Year	Survey	N	Sex(%)	Maturity State (%)				
				Non Spawners	Mature	Ripe	Spent	Sex Unknown
1980 (Lakes)	1	21	M(48)	48	0	0	0	24
			F(28)	28	0	0	0	
	2	54	M(18)	16	2	0	0	41
			F(41)	34	7	0	0	
	3	36	M(47)	25	22	0	0	30
			F(23)	17	0	6	0	
1979 (Lakes)	1	31	M(35)	35	0	0	0	0
			F(65)	61	3	0	0	
	2	29	M(31)	21	10	0	0	0
			F(69)	52	17	0	0	
	3	20	M(65)	30	0	20	15	0
			F(35)	20	0	15	0	
1978 Canyanek Lakes	1 (CF200)	82	M(45)	19	26	0	0	7
			F(48)	15	32	0	0	
	2	59	M(63)	61	2	0	0	0
			F(37)	37	0	0	0	
	3	30	M(67)	46	20	0	0	0
			F(33)	34	0	0	0	
	4 (Nov'80)	10	M(100)	0	0	0	100	0
			F(0)	0	0	0	0	

Table 55. Least cisco gillnet catch summary statistics; 1978, 1979 and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Weight	Range Age (yrs)	Range F.L. (mm)	Range Weight (g)
1980	1	01-07 July	Richards Is. Lakes	13	19	3.9	1.9	202.2	68.0	116.5	105.6	1 - 7	100 - 325	8 - 400
			Richards Is. Coast	15	45	6.7	1.9	257.6	56.0	177.1	88.8	1 - 10	112 - 335	7 - 420
1979	1	28-29 June	Tuk Pen. Lakes	5	32	7.5	1.5	316.6	36.0	341.0	115.8	2 - 10	189 - 375	59 - 625
		18-20 July	Tuk Pen. Coast	6	32	5.2	1.7	247.8	55.8	150.3	81.6	1 - 8	115 - 312	13 - 275
1978	1	26-29 June	Bay 1 Lakes	0	-- No Data Available --									
			Tuk Pen. Coast	15	95	5.5	1.7	252.2	45.3	188.3	57.8	1 - 8	97 - 307	50 - 300
1980	2	01-06 Aug.	Richards Is. Lakes	13	54	3.6	2.4	200.3	85.3	130.2	142.6	1 - 9	97 - 357	10 - 575
			Richards Is. Coast	15	42	5.1	2.5	241.6	67.3	171.2	96.0	1 - 10	100 - 362	10 - 380
1979	2	01-07 Aug.	Tuk Pen. Lakes	10	29	5.9	2.0	294.8	57.4	340.3	190.9	1 - 10	132 - 428	27 - 1020
			Tuk Pen. Coast	6	16	4.8	1.7	233.9	49.7	131.8	89.5	1 - 7	115 - 302	11 - 325
1978	2	30 July-05 Aug.	Bay 1 Lakes	21	59	5.8	1.1	316.4	29.2	398.2	110.3	2 - 9	202 - 389	95 - 750
			Tuk. Pen. Coast	38	93	5.3	1.5	240.9	40.4	140.6	87.4	2 - 8	125 - 332	13 - 475
1980	3	05-10 Sept.	Richards Is. Lakes	13	41	2.9	2.3	208.9	91.6	188.5	188.7	1 - 8	103 - 347	7 - 575
			Richards Is. Coast	15	34	4.7	2.2	223.7	66.6	127.0	88.8	1 - 8	94 - 305	6 - 300
1979	3	16-20 Sept.	Tuk Pen. Lakes	4	20	6.1	1.7	295.2	44.2	275.9	98.9	2 - 8	174 - 333	51 - 430
			Tuk Pen. Coast	2	25	5.1	2.1	236.6	53.3	146.0	84.5	1 - 8	98 - 301	10 - 270
1978	3	01-04 Sept.	Bay 1 Lakes	21	24	5.6	1.3	299.1	43.7	354.8	152.3	3 - 8	188 - 360	65 - 640
			Tuk Pen. Coast	39	77	5.7	0.8	270.2	25.5	189.6	60.5	3 - 7	194 - 320	50 - 340
1980	All		Richards Is. Lakes	39	114	3.4	2.3	203.7	84.4	147.6	156.3	1 - 11	97 - 357	7 - 575
			Richards Is. Coast	45	121	5.6	2.4	242.5	64.1	160.6	93.0	1 - 10	94 - 362	6 - 420
1979	All		Tuk Pen. Lakes	19	81	6.6	1.9	303.5	47.2	324.7	145.1	1 - 10	132 - 428	27 - 1020
			Tuk Pen. Coast	14	73	5.1	1.8	240.9	53.3	144.8	83.5	1 - 8	98 - 312	10 - 325
1978	All		Bay 1 Lakes	42	83	5.7	1.2	311.4	34.7	385.5	124.7	2 - 9	188 - 389	65 - 750
			Tuk Pen. Coast	92	265	5.5	1.4	253.5	40.7	171.6	74.0	1 - 8	97 - 332	13 - 475

Table 56. Mean fork length ($\overline{F.L.}$), standard deviation (SD), number (n) and length range of least cisco caught during 1978, 1979 and 1980.

	Age (yrs)	0	1	2	3	4	5	6	7	8	9	10	11
1980	$\overline{F.L.}$		111	183	199	222	229	271	286	296	311	299	
Coastal	SD		9	-	11	20	9	18	20	12	29	24	
All	n		11	1	10	13	5	24	23	10	7	3	
Surveys	max		125	-	216	253	244	300	336	317	362	322	
	min		100	-	179	182	224	232	244	275	274	274	
1979	$\overline{F.L.}$		115	168	202	223	274	290	307	321	335	377	
Coastal	SD		18	32	20	26	24	25	27	29	7	-	
All	n		3	4	7	16	16	21	21	13	2	1	
Surveys	max		133	200	245	271	318	362	365	372	340	-	
	min		98	125	180	185	233	254	273	278	330	-	
1978	$\overline{F.L.}$		104	138	176	218	245	272	285	285			
Coastal	SD		7	30	21	19	22	16	16	25			
All	n		3	9	15	39	58	92	43	16			
Surveys	max		112	190	207	272	297	304	320	332			
	min		98	97	139	182	195	208	251	246			
1980	$\overline{F.L.}$		114	162	210	224	264	309	307	318	318		317
Lakes	SD		16	30	20	33	41	42	24	12	55		-
All	n		37	4	18	9	12	10	7	3	2		1
Surveys	max		176	180	245	270	325	347	327	331	357		-
	min		97	117	154	174	192	245	256	308	279		-
1979	$\overline{F.L.}$		132	191	211	222	294	299	316	325	347	390	
Lakes	SD		-	19	8	23	20	23	11	10	19	54	
All	n		1	4	2	3	4	16	24	17	6	2	
Surveys	max		-	217	216	247	313	350	338	347	375	428	
	min		-	174	211	201	266	244	298	312	323	351	
1978	$\overline{F.L.}$			202	216	267	302	320	338	369	372		
Lakes	SD			-	22	13	14	16	12	29	-		
All	n			1	4	5	14	45	11	2	1		
Surveys	max			-	240	288	325	375	360	289	-		
	min			-	188	256	273	284	313	348	-		

Table 57. Difference in mean fork length between lake-dwelling and coastal least cisco tested for significance (Ps.05) using Student's t-test. Samples from each year have been treated separately.

	1980					1979					1978				
	Mean fork length (mm)					Mean fork length (mm)					Mean fork length (mm)				
Age	Lakes	Coast	n-2	t.	Significance	Lakes	Coast	n-2	t.	Significance	Lakes	Coast	n-2	t.	Significance
1	114	111	46	0.592	Not Sig. (N.S.)	insufficient sample size					insufficient sample size				
2	insufficient sample size					191	168	6	1.236	N.S.	insufficient sample size				
3	210	199	26	2.490	p<.01	211	202	7	0.554	N.S.	216	176	17	3.356	p<.005
4	224	222	20	0.177	N.S.	222	223	17	Negative	N.S.	267	218	42	5.572	p<.0005
5	264	229	15	1.857	p<.05	294	274	18	1.530	N.S.	302	245	70	9.226	p<.0005
6	309	271	32	3.739	p<.0005	299	290	35	1.122	N.S.	320	272	135	16.49	p<.0005
7	307	286	28	2.325	p<.025	316	307	43	1.499	N.S.	338	285	53	10.26	p<.0005
8	318	296	11	4.231	p<.005	325	321	28	0.531	N.S.	369	285	16	4.432	p<.0005
9	318	311	7	-	N.S.	347	335	6	0.836	N.S.	insufficient sample size				

Table 58. Dry weight analysis and percent frequency of occurrence of coastal least cisco stomach contents.

		Number of stomachs analyzed	Mysidacea	Amphipoda	Ostracoda	Copepoda	Isopoda	Gastropoda	Plecoptera	Unid. Diptera	Chironomidae	Ceratopogonidae	Insecta	Polychaeta	Oligochaeta	Nematoda	Fish	Plant remains	Digested material	Total dry weight
Richards Island Coast	Dry Weight (gm)	n = 14	<0.01	0.01		0.05								0.01	<0.01			<0.01	0.07	0.14
	% Occurrence	n =	7	21		57								7	7			7	50	
Tuk Coast E. Channel to Parsleyut	Dry Weight (gm)	n = 41	0.06	0.35	<0.01	0.02	0.05	0.01	<0.01	<0.01	<0.01	<0.01	<0.01			<0.01	0.27	0.07	0.23	1.06
	% Occurrence	n =	20	49	2	12	17	5	2	2	5	2	2			5	7	20	51	
Tuk Coast Hutchison to McKinley	Dry Weight (gm)	n = 13	0.01	0.01		0.02				<0.01	<0.01		0.02		<0.01			<0.01	0.03	0.09
	% Occurrence	n =	8	15		38				8	8		31		8			15	46	

Table 59. Dry weight analysis and percent frequency of occurrence of lake-dwelling least cisco stomach contents.

		Number of stomachs analyzed	Acarina	Conchostraca	Notostraca	Amphipoda	Cladocera	Cumacea	Ostracoda	Copepoda	Chelicerata	Crustacea	Gastropoda	Pelecypoda	Plecoptera	Trichoptera	Hemiptera	Coleoptera	Hymenoptera	Diptera	Chironomidae	Simulidae	Insecta	Hirudinea	Nematoda	9 spine stickleback	Unid. fish	Plant remains	Foraminifera	Digested remains	Total dry weight
Richards Island Lakes	Dry Weight (gm)	n = 23	<0.01			0.05	<0.01		0.19	0.03		<0.01	0.81	0.49		0.73	0.32	<0.01	0.03	0.27	0.28	<0.01	0.15		<0.01	0.20	0.42	0.02	<0.01	1.55	5.54
	% Occurrence	n =	9			13	9		35	13		4	43	9		30	9	4	9	13	78	4	13		9	9	17	26	4	52	
West Tuk Peninsula Lakes	Dry Weight (gm)	n = 100	0.07	3.99	1.42	17.16	0.88		0.06	0.05	0.01		6.09	4.69	0.01	0.52				0.13	0.67	<0.01	1.01	<0.01	0.02	0.79	1.10	0.96		10.62	50.25
	% Occurrence	n =	37	23	19	60	20		24	9	1		39	38	1	20				5	59	1	13	1	6	7	16	48		60	
East Tuk Peninsula Lakes	Dry Weight (gm)	n = 24	<0.01		1.01	<0.01	3.39	0.40	<0.01	0.49			0.08			0.14					0.07		0.06			0.78	0.61	0.03		0.1	7.10
	% Occurrence	n =	4		46	4	58	8	4	29			13			33					50		17			8	8	25		29	

Table 60. Sexual maturity analysis of rainbow smelt caught in gillnets.

Year	Survey	N	Sex(%)	Maturity State (%)				
				Immature	Mature	Ripe	Spent	Sex Unknown
1980	1	9	M(78)	67	0	0	11	0
			F(22)	11	0	0	11	
	2	39	M(44)	39	5	0	0	28
			F(29)	26	3	0	0	
	3	43	M(58)	53	5	0	0	5
			F(37)	37	0	0	0	
1979	-- Insufficient Sample Size --							
1978	1	-- No Catch --						
	2	116	M(53)	19	34	0	0	2
			F(45)	42	3	0	0	
	3	77	M(30)	8	22	0	0	12
			F(58)	48	10	0	0	

Table 61. Rainbow smelt gillnet catch summary statistics, 1978, 1979 and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range F.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island 1, 56-84	15	7 (3)	M	7.3	0.6	253.3	18.5	121.4	20.6	7 - 8	229 - 289	100 - 160
					2	F	-	-	237.0	-	107.5	-	-	234 - 240	90 - 125
					10 (3)	T	7.3	0.6	252.2	18.5	119.0	19.7	7 - 8	229 - 289	90 - 160
1979	1	28-29 June 18-20 July	Tuk. Peninsula 4, 22a, 23 31, 31a, 32	6	1	M	8.0	-	212.0	-	75.0	-	-	-	-
					0	F	-	-	-	-	-	-	-	-	-
					2	T	6.5	-	172.0	-	45.0	-	5 - 8	132 - 212	15 - 75
1978	1	26-29 June	Tuk. Peninsula 1-26	15	0	M	-	-	-	-	-	-	-	-	-
					0	F	-	-	-	-	-	-	-	-	-
					0	T	-	-	-	-	-	-	-	-	-
1980	2	01-06 Aug.	Richards Island 1, 56-84	15	17 (15)	M	6.7	1.3	241.9	27.0	105.8	32.2	3 - 8	152 - 277	25 - 150
					11 (8)	F	6.0	1.7	213.5	46.2	83.2	47.3	4 - 9	146 - 270	20 - 150
					39 (25)	T	6.2	1.7	202.2	56.2	73.3	50.7	3 - 9	116 - 277	10 - 150
1979	2	01-07 Aug.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a	6	2	M	7.5	-	221.0	-	73.5	-	7 - 8	218 - 224	72 - 75
					2 (1)	F	4.0	-	177.5	-	68.5	-	-	112 - 243	12 - 125
					5	T	6.3	2.1	199.6	51.2	69.4	40.2	4 - 8	112 - 243	12 - 125
1978	2	30 July - 05 Aug.	Tuk. Peninsula 1 to 53	38	62	M	5.5	0.9	234.4	22.4	101.0	20.6	4 - 8	155 - 284	25 - 170
					52	F	5.7	1.1	240.9	21.7	104.0	30.3	4 - 8	196 - 287	50 - 170
					118 (114)	T	5.6	1.0	235.8	25.2	101.2	31.8	4 - 8	118 - 287	9 - 170
1980	3	05-10 Sep.	Richards Island 1, 56-84	15	25	M	-	-	255.9	18.8	127.3	32.8	-	200 - 279	54 - 170
					16	F	-	-	248.8	23.0	112.3	37.0	-	224 - 311	73 - 200
					43	T	-	-	251.1	22.2	118.7	36.4	-	200 - 311	47 - 200
1979	3	16-20 Sep.	Tuk. Peninsula 1, 4	2	0	M	-	-	-	-	-	-	-	-	-
					0	F	-	-	-	-	-	-	-	-	-
					1	T	-	-	234.0	-	110.0	-	-	-	-
1978	3	01-04 Sep.	Tuk. Peninsula 1 to 45	39	23	M	5.2	0.8	245.6	18.3	120.2	28.8	4 - 7	205 - 280	60 - 175
					45	F	4.8	1.1	234.4	29.3	103.7	42.4	3 - 7	179 - 283	40 - 175
					77	T	4.7	1.3	230.0	37.0	102.4	44.4	1 - 7	110 - 290	6 - 175
1980	all	01 July - 10 Sep.	Richards Island 1, 56-84	45	49 (18)	M	6.8	1.2	250.7	22.5	119.0	32.2	3 - 8	152 - 289	25 - 170
					29 (8)	F	6.0	1.7	234.6	36.6	100.9	41.9	4 - 9	146 - 311	20 - 200
					92 (28)	T	6.3	1.6	230.5	46.7	99.5	47.3	3 - 9	116 - 311	10 - 200
1979	all	28 June - 20 Sep.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a, 32	14	3	M	7.7	0.6	218.0	6.0	74.0	1.7	7 - 8	212 - 224	72 - 75
					2 (1)	F	4.0	-	177.5	-	68.5	-	-	112 - 243	12 - 125
					8	T	4.0	1.8	197.0	48.3	68.4	29.8	4 - 8	112 - 243	12 - 125
1978	all	26 June - 04 Sep.	Tuk. Peninsula 1 to 53	92	85	M	5.4	0.9	237.4	21.8	106.2	31.2	4 - 8	155 - 284	25 - 75
					97	F	5.3	1.2	237.9	25.6	103.9	36.3	3 - 8	179 - 287	40 - 175
					195	T	5.2	1.2	233.9	30.5	101.7	37.1	1 - 8	110 - 290	6 - 175

(n) - Number of fish for which ages were determined, when less than total n.

Table 62. Mean fork length ($\overline{F.L.}$), standard deviation (SD), number (n) and length range of rainbow smelt caught during 1978 to 1980.

Age (yrs)		0	1	2	3	4	5	6	7	8	9	10
Combined	$\overline{F.L.}$				146	147	192	227	244	244	259	
1980 n = 28	SD				14	1	46	15	15	28	-	
1979 n = 3	n				3	2	4	11	17	8	1	
1978 n = 15	max				155	148	235	245	271	289	-	
TOTAL = 46	min				130	146	132	198	218	212	-	

Table 63. Dry weight analysis and percent frequency of occurrence of rainbow smelt stomach contents.

		Number of stomachs analyzed	Mysidacea	Amphipoda	Cumacea	Isopoda	Oligochaeta	Nematoda	Fish	Plant matter	Digested remains	Total dry weight
All Coastal Sites	Dry Weight (g)	n = 28	0.34	<0.01	0.01	<0.01	<0.01	0.01	10.59	0.03	0.12	11.10
	% Occurrence		18	11	7	4	4	7	64	11	36	

Table 64. Broad whitefish gillnet catch summary statistics, 1978, 1979 and 1980. For 1979 and 1980 data from lakes and coastal sets are combined.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range F.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island 1, 56-84	28	60	M	8.2	2.6	389.3	74.4	886.6	459.3	2 - 15	162-532	38-2100
					53	F	8.6	2.5	407.6	70.4	1056.1	594.1	2 - 14	175-554	50-2975
					121	T	8.1	2.9	379.4	99.6	903.8	564.6	1 - 15	84-554	5-2975
1979	1	28-29 June 18-20 July	Tuk. Peninsula 4, 22a, 23 31, 31a, 32	11	26	M	8.2	3.5	381.9	88.1	896.7	465.6	1 - 13	169-502	59-1825
					11	F	10.4	2.2	415.5	47.8	986.4	332.6	6 - 13	302-482	260-1500
					38	T	8.9	3.3	384.6	90.1	899.4	447.0	1 - 13	115-502	14-1825
1978	1	26-29 June	Tuk. Peninsula 1-26	15	60	M	5.8	1.7	329.4	61.1	446.3	267.9	2 - 11	186-454	75-1300
					23	F	6.2	1.7	342.2	55.4	542.4	264.9	3 - 9	210-442	100-1150
					86	T	5.8	1.7	329.6	61.8	491.0	268.9	2 - 11	168-454	50-1300
1980	2	01-06 Aug.	Richards Island 1, 56-84	28	58	M	8.0	3.3	373.3	90.7	856.1	581.3	2 - 14	167-555	52-2875
					44	F	9.6	2.9	413.3	63.3	1097.2	505.0	3 - 16	245-555	200-2275
					108	T	8.3	3.5	376.9	98.1	907.6	584.5	1 - 16	102-555	12-2875
1979	2	01-07 Aug.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a	16	46	M	5.8	3.5	317.2	104.6	569.5	431.0	1 - 12	142-470	35-1500
					46	F	7.6	3.6	365.2	103.0	822.9	470.1	1 - 15	122-495	19-1850
					116	T	5.5	4.0	299.3	126.1	560.2	493.6	0+- 15	89-495	8-1850
1978	2	30 July - 05 Aug.	Tuk. Peninsula 1 to 53	38	15	M	5.9	1.4	354.4	55.8	610.7	266.1	3 - 8	235-420	130-1000
					5	F	5.8	0.4	408.2	20.9	960.0	201.2	5 - 6	380-428	750-1200
					25	T	5.3	1.8	329.7	95.6	574.8	363.1	2 - 8	95-428	9-1200
1980	3	05-10 Sep.	Richards Island 1, 56-84	28	46	M	7.0	2.3	417.2	90.9	1239.5	669.7	1 - 12	177-557	66-2675
					47	F	5.9	2.5	379.1	100.5	992.0	683.9	1 - 11	162-533	49-3225
					121	T	5.5	2.9	345.6	130.9	880.6	743.9	1 - 12	90-557	7-3225
1979	3	16-20 Sep.	Tuk. Peninsula 1, 4	6	35	M	5.7	3.2	318.5	93.0	540.6	396.3	1 - 12	171-460	60-1370
					24	F	6.5	3.6	343.0	91.9	651.0	485.6	1 - 13	181-470	73-1470
					74	T	5.3	3.6	301.7	105.4	498.5	435.7	0+- 13	113-470	14-1470
1978	3	01-04 Sep.	Tuk. Peninsula 1 to 45	39	14	M	4.1	1.4	326.4	50.8	493.6	247.0	2 - 6	240-417	200- 980
					4	F	4.0	0.8	308.5	19.8	385.0	107.5	3 - 5	282-329	250- 490
					21	T	4.0	1.3	300.2	75.9	416.8	249.7	2 - 6	87-417	8- 980
1980	all	01 July - 10 Sep.	Richards Island 1, 56-84	88	164	M	7.8	2.8	391.5	86.4	975.5	588.2	1 - 15	162-557	38-2875
					144	F	8.0	3.0	400.0	80.4	1047.4	598.3	1 - 16	162-555	49-3225
					350	T	7.2	3.4	366.9	111.8	896.9	636.1	1 - 16	84-557	5-3225
1979	all	28 June - 20 Sep.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a, 32	33	107	M	6.4	3.5	333.3	100.1	639.6	449.4	1 - 13	142-502	35-1825
					81	F	7.7	3.6	365.4	95.8	794.2	466.6	1 - 15	122-495	19-1850
					228	T	6.0	4.0	314.3	118.1	596.7	486.0	0+- 15	89-502	8-1850
1978	all	26 June - 04 Sep.	Tuk. Peninsula 1 to 53	92	89	M	5.5	1.7	333.2	58.9	508.4	265.6	2 - 11	186-454	75-1300
					32	F	5.9	1.6	348.3	55.6	588.0	292.1	3 - 9	210-442	100-1200
					132	T	5.4	1.8	325.0	71.7	495.1	287.7	2 - 11	87-454	8-1300

Table 65. Sexual maturity analysis of broad whitefish caught in gillnets.

Year	Survey	N	Sex(%)	Sexual Maturity				Sex Unknown (%)
				Non Spawners (%)	Mature (%)	Ripe (%)	Spent (%)	
1980	1	121	M(50)	49	1	0	0	8
			F(42)	39	3	0	0	
	2	103	M(53)	53	0	0	0	5
			F(42)	37	5	0	0	
	3	120	M(38)	37	1	0	0	24
			F(38)	38	0	0	0	
1979	1	45	M(54)	50	4	0	0	0
			F(36)	27	9	0	0	
	2	123	M(39)	39	0	0	0	19
			F(42)	41	0	0	0	
	3	80	M(51)	49	0	0	2	16
			F(33)	33	0	0	0	
1978	1	87	M(68)	68	0	0	0	5
			F(27)	27	0	0	0	
	2	25	M(60)	60	0	0	0	20
			F(20)	20	0	0	0	
	3	21	M(67)	67	0	0	0	14
			F(19)	19	0	0	0	

Table 66. Broad whitefish gillnet catch summary statistics; Canyanek Drainage, 1978.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean F.L.	S.D. F.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range F.L. (mm)	Range Weight (gm)
1978	2		Canyanek	21	65	M	7.9	2.0	413.8	52.5	1118.3	420.3	2 - 13	267 - 519	250 - 2350
					65	F	8.1	1.8	416.7	41.0	1112.8	322.2	3 - 12	283 - 512	310 - 2050
						T	8.0	1.9	415.0	46.9	1113.5	372.3	2 - 13	267 - 519	250 - 2350
	3		Canyanek	20	13	M	7.0	2.5	387.1	67.4	906.5	373.5	2 - 9	250 - 456	220 - 1400
					23	F	7.6	2.0	407.6	52.8	1045.4	421.7	3 - 12	290 - 499	325 - 1825
					37	T	7.3	2.2	397.9	59.3	979.2	411.3	2 - 12	250 - 499	220 - 1825
	2 & 3		Canyanek	41	78	M	7.7	2.1	409.3	55.7	1083.0	418.2	2 - 13	250 - 519	220 - 2350
					88	F	8.0	1.9	414.3	44.2	1095.2	349.6	3 - 12	283 - 512	310 - 2050
					166	T	7.8	2.0	411.2	50.2	1084.0	384.1	2 - 13	250 - 519	220 - 2350

Table 67. Mean fork length ($\overline{F.L.}$), standard deviation (SD), number (n) and length range of broad whitefish caught during 1978, 1979 and 1980.

Age (yrs)		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1980	$\overline{F.L.}$		211	153	230	239	301	310	380	386	443	426	438	444	469			
Coastal	SD		23	-	100	82	23	3	41	-	23	51	49	-	-			
All surveys	n		2	1	2	3	4	3	4	1	3	5	7	1	1			
	max		227	-	300	327	323	313	414	-	470	515	520	-	-			
	min		195	-	159	166	276	308	323	-	429	390	374	-	-			
1979	$\overline{F.L.}$	95	126	164	234	295	299	346	364	405	413	429	465	455				503
Coastal	SD	-	21	-	-	27	17	48	17	19	20	9	12	27				-
All surveys	n	1	4	1	1	3	5	5	8	8	14	6	3	4				1
	max	-	144	-	-	316	313	427	400	425	443	440	474	488				-
	min	-	101	-	-	265	270	302	350	374	383	414	451	424				-
1978	$\overline{F.L.}$		89	185	246	280	325	368	366	389	368		454					
Coastal	SD		15	54	42	43	36	41	26	27	60		-					
All surveys	n		3	13	8	24	21	35	18	10	4		1					
	max		100	282	303	334	380	428	421	442	447		-					
	min		72	112	182	146	248	263	318	340	302		-					
1980	$\overline{F.L.}$		141	184	243	299	326	383	409	434	426	437	452	454	455	451	535	482
Lakes	SD		38	18	37	23	37	55	52	51	37	43	48	48	56	34	4	52
All surveys	n		22	19	14	12	15	26	42	39	43	24	18	16	5	4	2	2
	max		211	218	287	334	402	489	495	542	525	547	555	557	554	492	538	519
	min		84	159	167	254	278	272	323	350	371	361	400	400	422	411	532	455
1979	$\overline{F.L.}$	99	154	207	259	277	305	341	380	393	414	440	441	465	471	493	490	
Lakes	SD	8	17	31	16	21	19	13	30	17	21	21	29	20	31	12	5	
All surveys	n	7	60	13	9	19	11	11	23	36	37	51	18	20	12	6	3	
	max	113	196	261	275	315	344	365	461	434	460	488	489	499	505	508	495	
	min	89	104	167	229	237	280	327	325	362	371	407	392	434	390	472	485	
1978	$\overline{F.L.}$			257	297	320	340	389	406	419	430	447	472	483	474			
Canyanek	SD			9	7	32	56	27	21	32	31	23	51	25	-			
Lakes	n			3	17	3	4	9	30	53	34	17	3	4	1			
	max			267	320	345	416	432	442	512	515	485	502	519	-			
	min			250	273	284	284	354	358	371	376	407	414	462	-			

Table 68. Difference in mean fork length between lake and coastal-caught broad whitefish tested for significance ($P \leq .05$) using Student's t-test.

	Coastal sample (1978)			Lake sample (1978)				
Age	Mean F.L.	S.D.	N	Mean F.L.	S.D.	N	t-value	Significance
2	185	54	13	257	9	3	2.2433	0.025
3	246	42	8	297	7	17	4.9782	$p < .0005$
4	280	43	24	320	32	3	1.5153	$p < .10 > .05$
5	325	36	21	340	56	4	0.7016	Not sig.
6	368	41	35	389	27	9	1.4509	$p < .10 > .05$
7	366	26	18	406	21	30	5.8396	$p < .0005$
8	389	27	10	419	32	53	2.7789	$p < .005$
9	368	60	4	430	31	34	3.4132	$p < .005$

Table 69. Dry weight analysis and percent frequency of occurrence of broad whitefish stomach contents from lakes.

		Total analyzed	Acarina	Conchostraca	Notostraca	Amphipoda	Cladocera	Ostracoda	Copepoda	Crustacea	Gastropoda	Pelecypoda	Plecoptera	Trichoptera	Hemiptera	Coleoptera	Diptera	Chironomidae	Tipulidae	Simuliidae	Insecta	Hirudinea	Nematoda	Eggs	Fish	Isopoda	Oligochaeta	Ceratopogonidae	Ascidiacea	Priapulida	Plant remains	Digested remains	Total dry weight
Richards Island Shallow Lakes	Dry Weight in Stomachs	n = 66	<0.01	0.60	2.18	1.99	<0.01	<0.01	<0.01	< .01	55.90	6.61	0.01	1.54	0.09	0.03	0.07	2.97	0.23	0.94	0.01	0.05	<0.01	0.01	<0.01						1.20	19.68	94.13
	% Frequency in Stomachs		3.0	16.7	25.8	28.8	3.0	4.6	1.5	1.5	74.2	77.3	3.0	31.8	3.0	3.0	10.6	80.3	10.6	6.1	4.6	4.6	10.6	3.0	1.5						80.3	74.2	
Richards Island Deep Lakes	Dry Weight in Stomachs	n = 13	<0.01		0.03	0.31		<0.01			27.41	4.7	0.02	0.40	0.37			3.2	0.01		<0.01		<0.01	<0.01	0.02						0.18	10.52	47.14
	% Frequency in Stomachs		7.7		23.1	23.1		7.7			76.9	92.3	7.7	46.2	7.7			100.0	23.0		7.7		7.7	7.7	15.4						84.6	84.6	
Tuktoyaktuk Peninsula Lakes	Dry Weight in Stomachs	n = 45		0.02	4.98	0.04	0.03	0.23	0.02		3.52	1.40		0.01				0.88					<0.01			0.02	<0.01				0.16	5.27	16.58
	% Frequency in Stomachs			15.6	51.1	6.7	22.2	4.4	6.7		28.9	57.8		2.2				71.1					6.7			2.2	2.2				35.6	28.9	
Bay 1 Drainage	Dry Weight in Stomachs	n = 185	<0.01	3.74	1.43	9.22	0.10	0.04	<0.01	0.05	192.1	26.02	<0.01	3.27		0.03	0.04	2.20	0.05		7.92	<0.01	0.01	0.07	0.80		<0.01	<0.01			3.94	90.07	341.1
	% Frequency in Stomachs		0.5	13.0	13.0	22.7	7.6	10.8	0.5	0.5	91.9	80.0	0.5	14.6		1.6	3.8	68.1	0.5		8.1	0.5	11.4	1.08	4.8		1.1	0.5			67.6	80.5	
Bay 4 Drainage	Dry Weight in Stomachs	n = 59	<0.01	1.61	0.73	4.84	<0.01	0.95			23.39	6.18	0.02	0.06			0.22	2.06			0.35		<0.01						0.16	<0.01	0.91	10.15	51.63
	% Frequency in Stomachs		6.8	20.3	28.8	44.1	3.4	27.1			78.0	74.6	1.7	10.2			11.9	83.1			20.3		5.1						1.7	1.7	66.1	78.0	

Table 70. Dry weight analysis and percent frequency of occurrence of broad whitefish stomach contents from coastal locations.

		Number of stomachs analyzed	Mysidacea	Amphipoda	Cumacea	Isopoda	Gastropoda	Pelecypoda	Chironomidae	Polychaeta	Oligochaeta	Priapulida	Nematoda	Foraminiferida	Ostracoda	Copepoda	Diptera	Eggs	Fish	Plant remains	Digested remains	Total dry weight
Richards Island Coast	Dry Weight in Stomachs	n = 18	0.02	0.04	<0.01	0.01	<0.01	1.49	0.01	0.19	<0.01	0.02	0.01	<0.01						0.13	6.32	8.22
	% Frequency in Stomachs		5.6	4.4	5.6	5.6	11.1	72.2	22.2	61.1	5.6	22.2	5.6	5.6						62.2	100.0	
Tuktoyaktuk Peninsula Coast	Dry Weight in Stomachs	n = 37		0.11		0.03	0.10	1.70	0.76	<0.01	<0.01		<0.01		<.01	<.01	0.01	0.02	0.05	0.12	12.10	15.00
	% Frequency in Stomachs			8.1		5.4	5.4	37.8	29.7	5.4	2.7		2.7		2.7	2.7	5.4	5.4	2.7	27.0	94.6	

Table 71. Lake whitefish gillnet catch summary statistics, 1978, 1979 and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range F.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island 1, 56-84 (incl. lakes)	28	14	M	11.1	2.0	391.7	57.6	827.5	389.4	8-15	288-510	285-1800
					14	F	10.8	4.3	347.2	91.2	679.9	450.6	3-19	169-468	55-1750
					31	T	10.6	3.4	358.0	82.9	701.7	430.7	3-19	169-510	55-1800
1979	1	28-29 June 18-20 July	Tuk. Peninsula 4, 22a, 23 31, 31a, 32	6	9	M	7.8	4.7	284.4	103.2	414.7	484.8	2-14	166-449	47-1325
					3	F	6.5	6.4	321.7	138.0	665.3	581.6	2-11	165-425	46-1200
					24	T	4.9	4.3	231.2	100.5	274.6	412.2	1-14	92-449	8-1325
1978	1	26-29 June	Tuk. Peninsula 1-26	15	34	M	6.6	2.3	288.1	80.1	363.7	321.4	3-11	168-434	50-1150
					16	F	7.9	2.6	302.1	74.6	402.8	322.2	3-13	182-428	55-1050
					53	T	6.9	2.5	286.4	79.9	358.7	317.9	3-13	164-434	50-1150
1980	2	01-06 Aug.	Richards Island 1, 56-84 (incl. lakes)	28	15	M	10.4	2.6	400.3	69.1	927.9	407.5	6-13	282-475	275-1375
					27	F	11.0	2.4	419.7	54.8	1065.7	379.1	6-17	251-527	150-1850
					48	T	10.7	3.4	383.7	100.1	901.7	478.5	2-17	103-527	10-1850
1979	2	01-07 Aug.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a	6	6	M	7.0	3.3	294.3	97.5	404.2	421.7	4-13	200-478	125-1250
					4	F	9.8	2.5	327.8	48.4	506.3	231.3	7-13	299-400	350-850
					17	T	6.0	3.6	248.7	98.0	289.7	323.8	1-13	100-478	12-1250
1978	2	30 July - 05 Aug.	Tuk. Peninsula 1 to 53	38	12	M	6.3	2.7	237.0	65.9	207.5	200.7	3-11	153-346	50-650
					6	F	7.7	1.8	284.5	56.7	312.5	228.4	6-11	211-385	90-750
					34	T	5.4	2.5	223.7	64.4	168.5	181.5	2-11	129-385	15-750
1980	3	05-10 Sep.	Richards Island 1, 56-84 (incl. lakes)	28	9	M	9.6	3.0	299.6	85.9	941.7	534.6	6-15	263-507	225-1775
					15	F	9.3	2.5	389.4	88.4	954.2	571.5	4-13	197-475	88-1850
					27	T	8.7	3.1	366.4	111.9	848.4	585.3	3-15	118-507	64-1850
1979	3	16-20 Sep.	Tuk. Peninsula 1, 4	2	3	M	6.0	3.6	238.7	65.1	203.3	145.0	3-10	169-298	60-350
					0	F									
					18	T	4.8	2.3	208.9	51.3	134.4	93.3	2-10	127-298	25-350
1978	3	01-04 Sep.	Tuk. Peninsula 1 to 45	39	9	M	7.6	1.7	312.3	56.6	403.3	197.9	4-10	198-385	85-700
					6	F	8.0	2.4	315.7	73.8	458.0	337.7	5-12	224-422	133-950
					18	T	7.4	2.0	299.4	65.1	379.1	253.4	4-12	198-422	85-950
1980	all	01 July - 10 Sep.	Richards Island 1, 56-84 (incl. lakes)	45	38	M	10.5	2.5	396.9	67.7	893.2	425.4	6-15	263-510	225-1800
					56	F	11.0	3.2	393.5	79.2	939.1	471.4	3-19	169-527	55-1850
					106	T	10.2	3.4	371.8	98.4	828.8	496.8	2-19	103-527	10-1850
1979	all	28 June - 20 Sep.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a, 32	14	18	M	7.2	3.9	280.1	93.2	375.9	414.4	2-14	166-478	47-1325
					7	F	8.7	3.8	325.1	86.8	574.4	383.1	2-13	165-425	46-1200
					59	T	5.2	3.5	229.4	87.6	235.5	319.9	1-14	92-478	8-1325
1978	all	26 June - 04 Sep.	Tuk. Peninsula 1 to 53	92	55	M	7.7	2.3	280.9	76.9	336.1	286.4	3-11	153-434	30-1150
					28	F	7.9	2.3	301.3	69.3	395.3	301.5	3-13	182-428	55-1050
					105	T	6.5	2.5	268.3	78.7	300.6	282.8	2-13	129-434	15-1150
1980	1	01-07 July	Richards Island (excl. lakes)	15	19	T	10.1	4.0	322.6	81.3	-	-	3-19	169-428	-
1980	2	01-06 Aug.	Richards Island (excl. lakes)	15	13	T	7.9	4.2	273.3	108.2	-	-	2-13	103-434	-
1980	3	05-10 Sep.	Richards Island (excl. lakes)	15	9	T	6.3	2.3	268.0	69.4	-	-	3-9	165-365	-
1980	all	01 July - 10 Sep	Richards Island (excl. lakes)	45	41	T	8.6	-	295.0	-	-	-	2-19	103-434	-

Table 72. Sexual maturity analysis of lake whitefish caught in gillnets.

Year and Location	Survey	N	Sex %	Sexual Maturity			
				Non Spawners %	Mature %	Ripe %	Sex Unknown %
1980 Richards Island Lakes	1	12	M(58)	58	0	0	0
			F(42)	42	0	0	
	2	34	M(36)	33	3	0	0
			F(64)	44	20		
	3	18	M(33)	11	22	0	0
			F(67)	50	17	0	
1980 Coastal Locations	1	19	M(37)	37	0	0	16
			F(48)	48	0	0	
	2	17	M(24)	18	6	0	29
			F(47)	41	6	0	
	3	9	M(33)	33	0	0	33
			F(33)	33	0	0	
1979 Coastal and Lake Locations	1	21	M(39)	39	0	0	57
			F(5)	5	0	0	
	2	17	M(39)	39	0	0	33
			F(29)	24	5	0	
	3	18	M(18)	12	6	0	83
			F(0)	0	0	0	
1978 Coastal Locations	1	57	M(65)	65	0	0	7
			F(28)	28	0	0	
	2	32	M(37)	37	0	0	44
			F(18)	18	0	0	
	3	18	M(50)	50	0	0	17
			F(33)	33	0	0	

Table 73. Mean fork length ($\overline{F.L.}$), standard deviation (SD), number (n) and length range of lake whitefish caught during 1978, 1979 and 1980.

Age (yrs)		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1980	$\overline{F.L.}$			106	174	151	205	267	284	303	306	340	326	387	388	335	423				406
Coastal	SD			3	0	28	-	18	9	34	2	53	-	33	41	-	7				-
All	n			3	2	3	1	3	3	7	3	4	1	4	3	1	2				1
Surveys	max			109	174	169	-	286	290	365	308	390	-	430	434	-	428				-
	min			103	174	118	-	251	274	272	304	275	-	351	355	-	418				-
1979	$\overline{F.L.}$		122	173	178	201	241	243	271	278	313	299	346	390	439	426	414	440			
Coastal	SD		37	33	17	31	17	28	34	21	23	1	-	9	39	-	-	28			
All	n		5	10	13	6	5	3	4	3	4	2	1	2	3	1	1	2			
Surveys	max		186	256	210	246	254	275	302	301	339	299	-	396	478	-	-	460			
	min		92	127	145	152	212	223	236	259	284	298	-	383	400	-	-	420			
1978	$\overline{F.L.}$			185	169	195	211	255	289	312	361	370	396	399	375						
Coastal	SD			-	20	14	21	29	39	47	42	40	33	33	-						
All	n			1	16	12	14	11	20	16	7	5	5	2	1						
Surveys	max			-	220	211	263	296	368	428	428	405	434	422	-						
	min			-	129	172	182	204	211	254	305	322	346	376	-						
1980	$\overline{F.L.}$					197	245	300	448	423	426	422	403	437	462	453	450	443	405		
Lakes	SD					-	-	-	-	33	46	39	32	27	38	24	67	-	-		
All	n					1	1	1	1	4	7	8	9	12	12	3	3	1	1		
Surveys	max					-	-	-	-	460	475	482	438	472	527	472	507	-	-		
	min					-	-	-	-	382	330	354	335	339	410	426	376	-	-		

Table 74. Difference in mean fork length between lake and coast-caught lake whitefish tested for significance ($P \leq .05$) using Student's t-test.

	Coastal sample (1978)			Lake sample (1980)				
Age	Mean F.L.	S.D.	N	Mean F.L.	S.D.	N	t value	Significance
8	312	47	16	423	33	4	4.415	$p < .0005$
9	361	42	7	426	46	7	2.761	$p < .01$
10	370	40	5	422	39	8	2.412	$p < .025$
11	396	33	5	403	32	9	0.388	Not signif.
12	399	33	2	437	27	12	1.806	$p < .05$

Table 75. Dry weight analysis and percent frequency of occurrence of lake whitefish stomach contents from lakes.

		Number of stomachs analyzed	Acarina	Notostraca	Conchostraca	Amphipoda	Cladocera	Crustacea	Chelicerata	Gastropoda	Pelecypoda	Trichoptera	Hemiptera	Chironomidae	Tipulidae	Muscidae	Simulidae	Hirudinea	Nematoda	Eggs	Fish	Plant material	Digested remains	Total dry weight
Richards Island Lakes	Dry Weight in Stomachs	n = 25	0.01	0.23		1.68	<0.01	<0.01	<0.01	25.54	0.54	0.02	0.02	0.43	0.12	<0.01	<0.01	<0.01	0.04	<0.01	0.14	0.17	9.55	38.45
	% Frequency in Stomachs		48	8		32	4	4	4	92	64	16	4	48	4	4	4	4	52	4	12	92	80	
Tuktoyaktuk Peninsula Lakes	Dry Weight in Stomachs	n = 4	<0.01	0.85	<0.01	0.74	<0.01			0.59	0.21			0.02					<0.01			0.17	0.50	3.08
	% Frequency in Stomachs		25	75	25	100	50			100	50			100					25			75	50	

Table 76. Dry weight analysis and percent frequency of occurrence of lake whitefish stomach contents from coastal locations.

		Number of stomachs analyzed	Mysidacea	Amphipoda	Copepoda	Isopoda	Gastropoda	Pelecypoda	Chironomidae	Insecta	Ascidaceae	Polychaeta	Oligochaeta	Priapulidae	Nematoda	Fish	Plant material	Digested remains	Total dry weight
Richards Is. Coast	Dry Weight in Stomach	n = 10	0.13	0.19		0.11	<0.01	0.94	0.02		0.03	0.11	1.87	0.01			0.10	4.38	7.89
	% Frequency in Stomachs		10	50		20	10	50	10		10	20	10	10			50	80	
Tuk. Coast East Channel To Tuk. Hrbr.	Dry Weight in Stomach	n = 28	0.05	0.39	<0.01	12.80		0.05	<0.01	0.21					<0.01	0.65	1.17	1.69	17.01
	% Frequency in Stomachs		18	36	4	64		4	4	7					7	4	50	38	
Tuk. Coast Bay 10 to Bay 22	Dry Weight in Stomach	n = 11	<0.01	<0.01				1.88		<0.01				0.06	<0.01		0.05	0.58	2.57
	% Frequency in Stomachs		9	9				27		9				9	9		45	45	

Table 77. Sexual maturity analysis of inconnu caught in gillnets.

Year	Survey	N	Sex(%)	Sexual Maturity				
				Immature (%)	Mature (%)	Ripe (%)	Spent (%)	Sex(%) Unknown
1980	1	28	M(35)	35	0	0	0	0
			F(65)	65	0	0	0	
	2	34	M(65)	65	0	0	0	5
			F(30)	30	0	0	0	
	3	18	M(50)	50	0	0	0	0
			F(50)	50	0	0	0	
1979	1	4	M(50)	50	0	0	0	0
			F(50)	50	0	0	0	
	2	8	M(38)	38	0	0	0	0
			F(50)	50	0	0	0	
	3	9	M(66)	11	33	0	22	0
			F(53)	33	0	0	0	
1978	1	28	M(53)	53	0	0	0	0
			F(47)	47	0	0	0	
	2	15	M(60)	60	0	0	0	13
			F(27)	27	0	0	0	
	3	40	M(38)	38	0	0	0	10
			F(53)	53	0	0	0	

Table 78. Inconnu gillnet catch summary statistics, 1978, 1979 and 1980.

Year	Survey	Date	Location	Number Sets	Number Fish	Sex	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Wt.	Range Age (yrs)	Range F.L. (mm)	Range Wt. (g)
1980	1	01-07 July	Richards Island 1, 56-84	15	10	M	9.8	1.9	595.8	84.8	2148.5	967.7	7 - 13	504 - 749	1225 - 4050
					18	F	11.2	3.2	650.6	128.9	3141.4	2140.0	7 - 17	475 - 956	1050 - 9200
					29	T	10.6	2.8	628.1	115.6	2750.2	1829.4	7 - 17	475 - 956	1050 - 9200
1979	1	28-29 June 18-20 July	Tuk. Peninsula 4, 22a, 23 31, 31a, 32	6	2	M	6.5	-	440.5	-	905.0	-	6 - 7	377 - 504	460 - 13
					2	F	5.5	-	433.0	-	710.0	-	5 - 6	427 - 439	700 - 720
					4	T	6.0	0.8	436.8	52.3	807.5	380.5	5 - 7	377 - 504	460 - 1350
1978	1	26-29 June	Tuk. Peninsula 1-26	15	15	M	7.4	1.8	481.3	91.1	1215.0	825.6	5 - 11	367 - 696	500 - 3600
					11	F	9.3	2.0	587.5	126.3	2170.5	1231.3	6 - 12	380 - 790	600 - 4575
					26	T	8.2	2.1	526.2	117.9	1619.2	1104.5	5 - 12	367 - 790	500 - 4575
1980	2	01-06 Aug.	Richards Island 1, 56-84	15	22	M	8.0	2.7	562.9	104.6	1842.1	1066.6	3 - 13	337 - 711	311 - 3925
					10	F	8.2	2.6	563.2	116.6	1967.5	1234.3	4 - 12	343 - 728	350 - 4225
					34	T	7.9	2.8	549.7	116.6	1791.9	1129.1	3 - 13	315 - 728	275 - 4225
1979	2	01-07 Aug.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a	6	3	M	6.3	2.5	430.3	90.5	766.7	453.7	4 - 9	340 - 521	350 - 1250
					4	F	7.0	2.9	462.8	155.4	1150.0	1151.1	4 - 11	313 - 681	300 - 2850
					9	T	6.8	2.7	460.4	141.6	1127.8	1047.9	4 - 11	313 - 682	300 - 2950
1978	2	30 July - 05 Aug.	Tuk. Peninsula 1 to 53	38	9	M	5.6	0.9	372.9	55.9	497.2	202.5	4 - 7	266 - 451	200 - 825
					4	F	5.5	2.6	379.0	189.2	862.5	1296.9	3 - 9	234 - 652	100 - 2800
					15	T	5.2	1.7	355.6	109.8	541.3	665.4	3 - 9	228 - 652	95 - 2800
1980	3	05-10 Sep.	Richards Island 1, 56-84	15	9	M	8.0	2.8	555.8	112.4	1701.7	868.3	3 - 12	316 - 686	290 - 3250
					9	F	10.3	2.6	653.1	95.8	2950.0	1749.7	6 - 14	515 - 797	1225 - 6550
					18	T	9.2	2.9	604.4	113.0	2325.8	1485.9	3 - 14	316 - 797	290 - 6550
1979	3	16-20 Sep.	Tuk. Peninsula 1, 4	2	6	M	8.5	1.9	538.0	92.5	1565.0	844.0	6 - 11	437 - 664	810 - 2860
					3	F	7.0	1.7	485.3	50.1	986.7	240.3	5 - 8	434 - 534	740 - 1220
					9	T	8.8	1.9	520.4	81.6	1372.2	737.1	5 - 11	434 - 664	740 - 2860
1978	3	01-04 Sep.	Tuk. Peninsula 1 to 45	39	15	M	6.5	1.7	445.0	75.8	811.3	437.7	4 - 9	328 - 526	310 - 1650
					21	F	7.2	1.8	477.0	109.0	1127.6	1103.5	4 - 11	330 - 791	300 - 5200
					41	T	6.6	1.9	447.3	101.3	927.0	871.9	4 - 11	283 - 791	200 - 5200
1980	all	01 July - 10 Sep.	Richards Island 1, 56-84	45	41	M	8.5	2.6	569.3	100.7	1886.0	992.3	3 - 13	316 - 749	290 - 4050
					37	F	10.2	3.1	627.6	121.9	2777.6	1865.4	4 - 17	343 - 956	350 - 9200
					81	T	9.1	3.0	589.9	119.4	2253.6	1532.2	3 - 17	315 - 956	275 - 9200
1979	all	28 June - 20 Sep.	Tuk. Peninsula 1, 4, 22a, 23, 31, 31a, 32	14	11	M	7.5	2.1	490.9	98.2	1227.3	768.0	4 - 11	340 - 664	350 - 2860
					9	F	6.7	2.1	463.7	100.5	997.8	737.3	4 - 11	313 - 681	300 - 2850
					22	T	7.1	2.2	480.7	108.6	1169.5	830.3	4 - 11	313 - 682	300 - 2950
1978	all	26 June - 04 Sep.	Tuk. Peninsula 1 to 53	92	39	M	6.6	1.7	442.3	87.0	894.1	641.1	4 - 11	266 - 696	200 - 3600
					36	F	7.7	2.3	499.9	137.2	1416.8	1239.7	3 - 12	234 - 791	100 - 5200
					82	T	6.9	2.2	455.5	122.2	1077.8	994.9	3 - 12	228 - 791	95 - 5200

Table 79. Mean fork length ($\overline{F.L.}$), standard deviation (SD), number (n) and length range of inconnu caught during 1978, 1979 and 1980.

		Age (yrs)																	
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1980	$\overline{F.L.}$			174	327	359	455	489	529	551	586	604	662	709	746	719	748	835	956
All	SD			10	15	44	16	28	38	40	37	50	49	18	33	7	6	-	-
Surveys	n			3	2	4	3	4	9	16	8	9	10	4	6	2	2	1	1
	max			165	337	418	468	515	598	618	638	662	740	728	797	724	752	-	-
	min			183	316	315	437	462	480	475	533	504	582	686	710	714	743	-	-
1979	$\overline{F.L.}$					324	431	432	455	493	550	647	673						
All	SD					14	5	37	43	38	40	50	12						
Surveys	n					3	2	5	3	3	2	2	2						
	max					340	434	480	504	534	578	682	681						
	min					313	427	377	423	458	521	611	664						
1978	$\overline{F.L.}$				231	339	370	403	451	509	567	670	677	689					
All	SD				3	39	53	32	36	54	37	19	112	-					
Surveys	n				3	12	8	18	14	11	8	3	6	1					
	max				234	398	439	460	534	636	652	692	791	-					
	min				228	272	266	358	402	450	540	656	492	-					

Table 80. Dry weight analysis and percent frequency of inconnu stomach contents.

		Number of stomachs analyzed	Mysidacea	Amphipoda	Copepoda	Isopoda	Pelecypoda	Chironomidae	Insecta	Oligochaeta	Priapulida	Nematoda	Pacific herring	Cod	Ninespine stickleback	Unidentified fish	Ammocoetes	Plant material	Digested remains	Total dry weight
Tuktoyaktuk Peninsula Bays	Dry Weight in stomachs (g)	n = 45	0.16	0.26	<0.01	2.73	1.40	<0.01	0.06	<0.01	0.02	0.02	5.62	1.1	0.27	145.9	0.12	0.05	5.9	163.61
	% Frequency in stomachs		29	13	2	16	2	2	2	2	2	18	2	2	2	60	2	11	49	

Table 81. Lake trout gillnet catch summary statistics.

Year	Survey	Male	Female	Total	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Weight	Range Age	Range Length (mm)	Range Weight (g)
1980	1	13	8	21	18.4	5.7(14)	564.6	96.2	2194.0	1199.2	10 - 32	416 - 760	750 - 5000
	2	12	10	22	20.3	6.8(11)	498.8	112.1	2820.5	1770.4	7 - 33	360 - 815	450 - 7450
	3	5	5	10	-	-	532.5	126.4	1917.5	1028.8	-	235 - 719	125 - 3900
	All	30	23	53	18.6	7.7(26)	572.7	109.3	2401.9	1462.4	4 - 33	235 - 815	125 - 7450
1979	1	4	2	6	16.2	4.3	543.2	54.6	1800.0	529.4	12 - 22	500 - 631	1300 - 2575
	2	1	6	7	10.9	5.0	587.4	90.6	2146.4	853.1	13 - 28	454 - 684	875 - 3030
	All	5	8	13	18.7	5.1	567.0	76.6	1986.5	716.2	12 - 28	454 - 684	875 - 3030
1978	2	2	1	3	15.5	7.8(2)	516.7	49.0	1618.3	423.4	10 - 21	467 - 565	1180 - 2025
	3	3	2	5	12.4	4.0	521.6	80.6	1716.0	786.7	6 - 15	402 - 627	850 - 2975
	All	5	3	8	13.3	4.8(7)	519.8	66.4	1679.4	638.3	6 - 21	402 - 627	850 - 2975

Table 82. Fork lengths (mm) of lake trout at each age class.

	Age (yrs)																				
	4	6	7	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	28	32	33
1980 All Surveys	235		360	458	483		494 600		580	600 529		557 545 518	713 548	685 598 669 530 523	506	654 554	656	761		657	760	701
1979 All Surveys						523	510 506	504	500		528			454 668	631	591	617		655	684		
1978 All Surveys		402		518	627				544 522 513					565								

Table 83. Comparison of the age-length relationship of lake trout taken from various regions of Arctic North America at latitudes between 69° and 70° North. All fish were otolith-aged.

Age	Tuktoyaktuk and Richards Island Lakes Fork length (mm) (n)	Murchison Basin[1] Fork length (mm) (n)	Itkillik Lake[2] Fork length (mm)(n)	Campsite Lake[2] Fork length (mm)(n)
5	204 (1)	160 (2)	320 (1)	183 (4)
10	480 (2)	225 (17)	379 (4)	261 (1)
15	530 (5)	380 (18)	461 (8)	381 (6)
20	586 (8)	510 (16)	478 (1)	496 (4)
25	655 (1)	590 (16)	444 (2)	502 (2)
30	≈700 (est)	640 (est)	706 (1) Age 28 yrs	-

[1] Lawrence et al. 1976.
[2] McCart et al. 1972.

Table 84. Dry weight and percent frequency of occurrence of lake trout stomach contents.

		Number of stomachs analyzed	Notostraca	Amphipoda	Cladocera	Gastropoda	Pelecypoda	Trichoptera	Hymenoptera	Chironomidae	Insecta	Nematoda	Ninespine stickleback	Unidentified fish	Eggs	Plant material	Digested remains	Total dry weight
Richards Island and Tuktoyaktuk Peninsula Lakes	Dry Weight (g)	N = 22	0.08	1.51	<0.01	8.30	0.05	5.74	<0.01	0.24	0.58	0.09	0.97	29.75	<0.01	0.68	7.17	55.16
	% Frequency of occurrence		9	32	5	9	14	45	5	59	36	32	9	50	5	64	45	

Table 85. Northern pike gillnet catch summary statistics.

Year	Survey	Male	Female	Total	Mean Age (yrs)	S.D. Age	Mean F.L. (mm)	S.D. F.L.	Mean Weight (g)	S.D. Weight	Range		
											Age	Length (mm)	Weight (g)
1980	1	13	10	23	6.6	1.9	453.7	73.2	738.7	388.0	3 - 12	304 - 630	200 - 1950
	2	8	2	12	5.7	2.5	394.8	118.5	551.8	461.3	2 - 10	207 - 591	62 - 1425
	3	3	10	13	7.8	1.3	504.0	46.9	1007.7	303.4	6 - 10	435 - 573	600 - 1550
	All	24	22	48	6.7	2.1	452.6	89.1	764.8	414.8	2 - 10	207 - 630	62 - 1950
1979	2	6	9	15	6.9	2.8	368.9	102.9	449.3	425.0	4 - 15	230 - 585	90 - 1575
	3	2	0	2	3.5	-	342.5	-	315.0	-	2 - 5	290 - 395	150 - 480
	All	8	9	17	6.5	2.9	365.8	98.4	433.5	404.2	2 - 15	230 - 588	90 - 1575
1978	2	6	8	15	6.1	2.1(11)	417.8	88.8	644.3	346.4	1 - 8	195 - 553	65 - 1440
	3	4	8	12	7.6	1.6(11)	495.7	88.9	1035.0	519.9	5 - 10	324 - 654	260 - 2025
	All	10	16	27	6.9	2.0(22)	452.4	95.6	809.6	462.6	1 - 10	195 - 654	65 - 2025

(n) Number of fish for which ages were determined, when less than total n.

Table 86. Age-length relationships of northern pike.

		Age (yrs)														
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1980	F.L.			207	285	342	375	454	461	501	573	570		630			
All	SD			-	18	-	33	35	28	28	-	19		-			
Surveys	n			1	3	1	8	5	13	9	1	4		1			
	max			-	304	-	439	484	514	558	-	591		-			
	min			-	268	-	337	402	417	453	-	544		-			
		Fork length (mm) at Age (yr)															
1979				290		230	269	388	365	415	514						585
All						251	267		337		471						
Surveys						279	395		342								
									431								
									389								
1978			195			402	313	356	416	400	520	654					
Canyanek							433	373	454	553	586						
All Surveys								395	407	457	521						
								324	462	520							
									476	480							

Table 87. Burbot gillnet catch summary statistics.

Year	Survey	Male	Female	Total	Mean Age (yrs)	S.D. Age	Mean T.L. (mm)	S.D. T.L.	Mean Weight (g)	S.D. Weight	Range		
											Age	Length (mm)	Weight (g)
1980	1	8	6	14	10.2	2.2	523.1	33.9	1130.4	267.7	6 - 15	447 - 573	700 - 1650
	2	1	2	4	11.3	1.0	575.8	3.8	1541.3	151.3	10 - 12	571 - 580	1315 - 1625
	3	2	3	5	16.6	5.2	589.0	89.2	1210.0	543.3	10 - 21	490 - 697	625 - 2100
	All	11	11	23	11.8	3.9	546.6	55.2	1219.1	350.8	6 - 21	447 - 697	625 - 2100
1979	1	2	3	5	9.2	1.8	555.0	29.7	1235.0	246.0	7 - 11	511 - 594	900 - 1550
	All	3	3	6	9.3	1.6	551.2	28.1	1150.8	301.5	7 - 11	511 - 594	730 - 1550
1978	1	1	4	5	-	-	645.2	63.0	1675.0	296.9	-	590 - 740	1300 - 2050
	All	1	4	5	-	-	645.2	63.0	1675.0	296.9	-	590 - 740	1300 - 2050

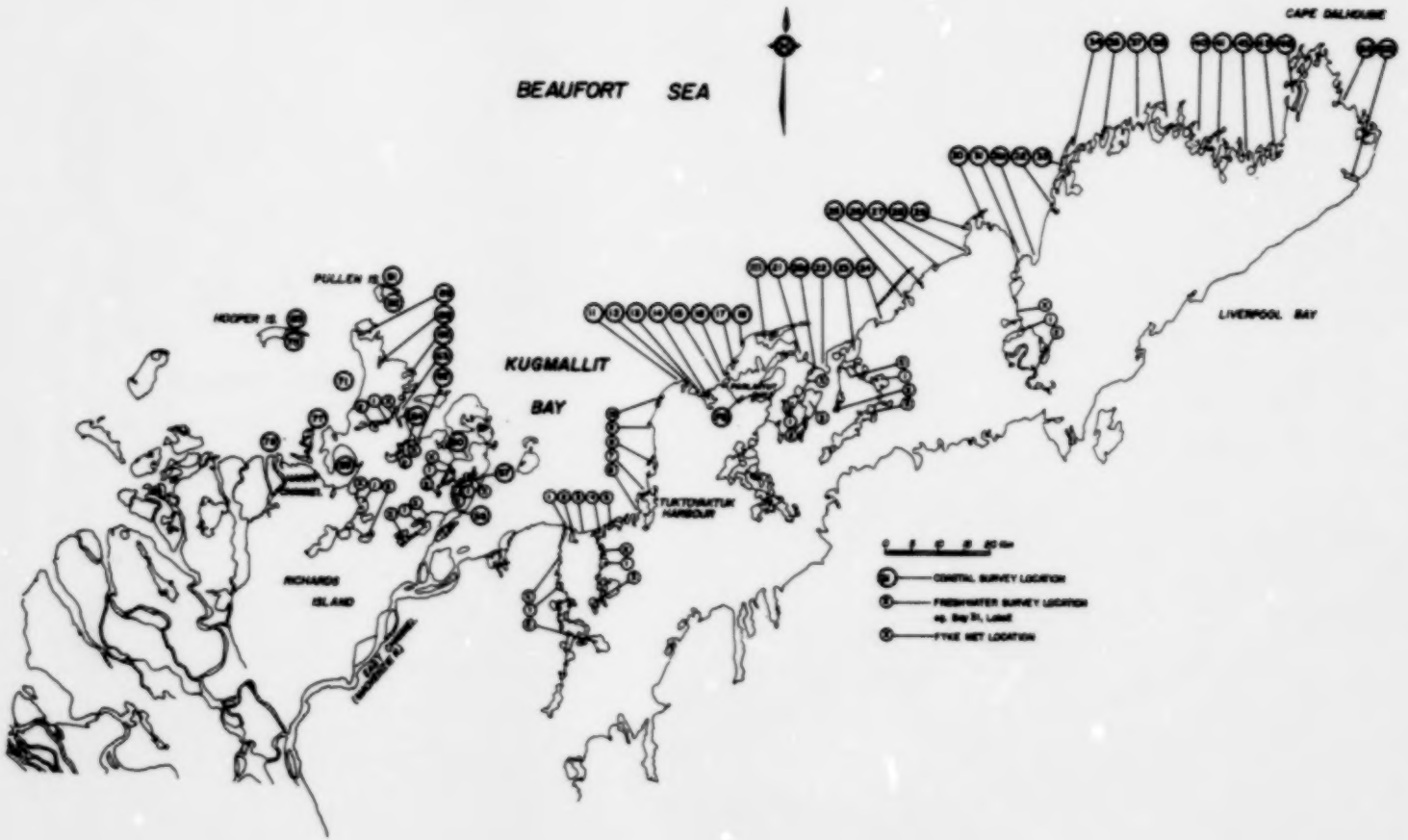


Fig. 1. Study area showing sample locations - 1978 to 1980.

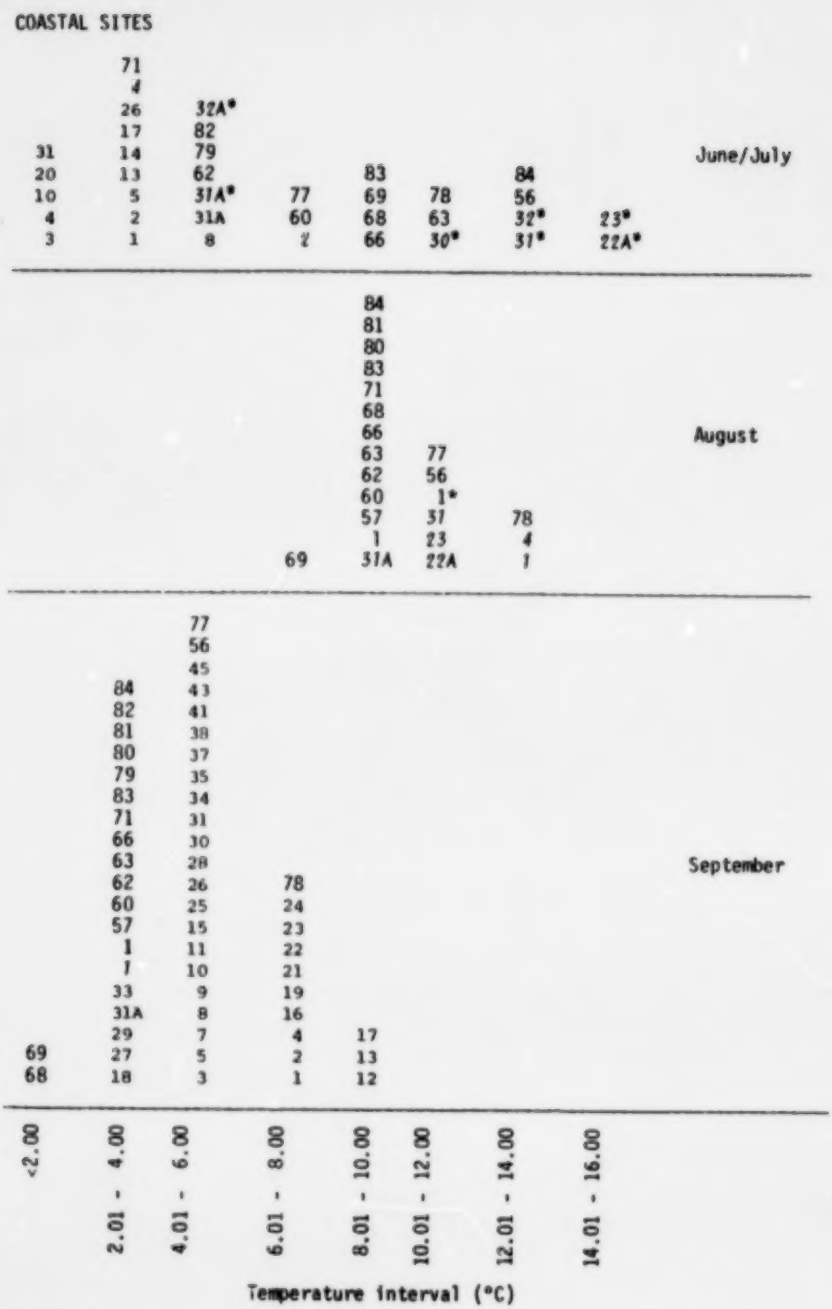


Fig. 2. Variability in surface water temperature (°C) at coastal sites during the June/July, August and September surveys of 1978-1980 (012 = 1978, *012* = 1979, 012 = 1980).

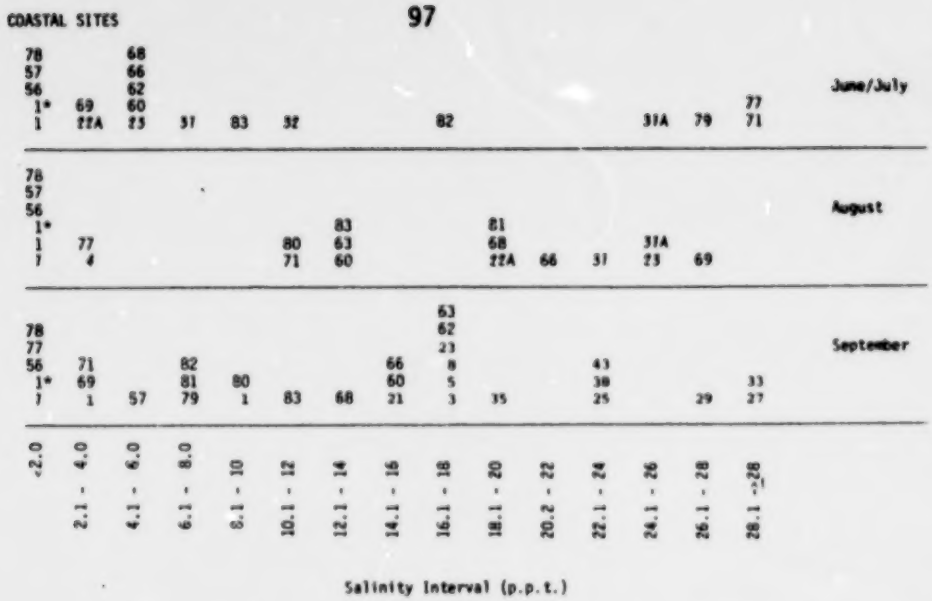


Fig. 3. Variability in surface salinity at coastal sites during the June/July, August and September surveys of 1978-1980 (= 1978, = 1979, 012 = 1980).

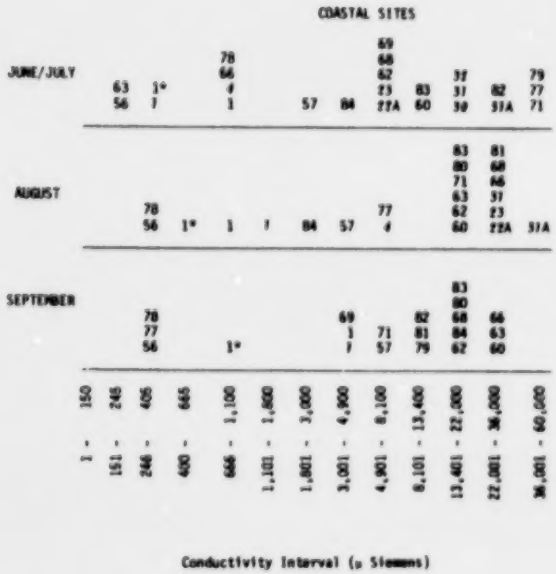


Fig. 4. Variability in surface conductivity (µSiemens) at coastal sites during the June/July, August and September surveys of 1979 and 1980 (*012*= 1979, 012 = 1980).

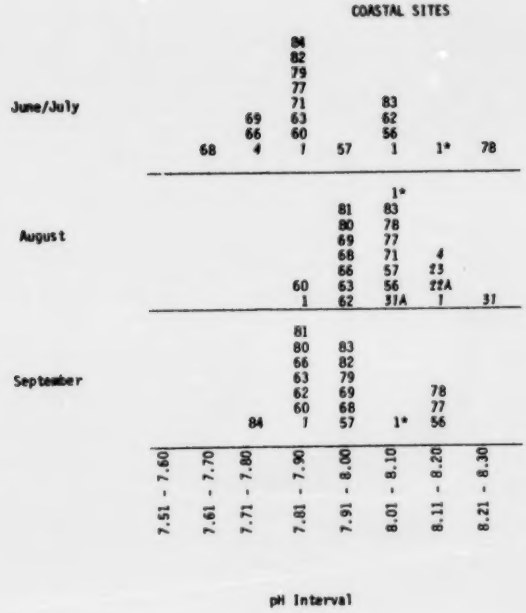


Fig. 5. Variability in surface pH at coastal sites during the June/July, August and September surveys of 1979 and 1980 (*012* = 1979, 012 = 1980).

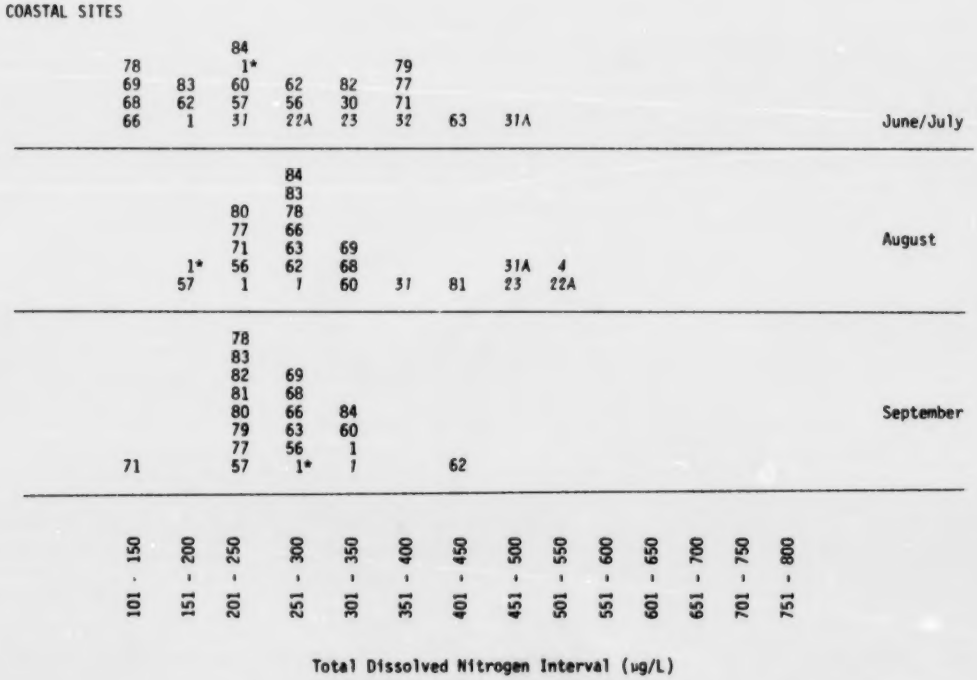


Fig. 6. Variability in surface TDN (µg L^{-1}) at coastal sites during the June/July, August and September surveys of 1979 and 1980 (*012* = 1979, 012 = 1980).

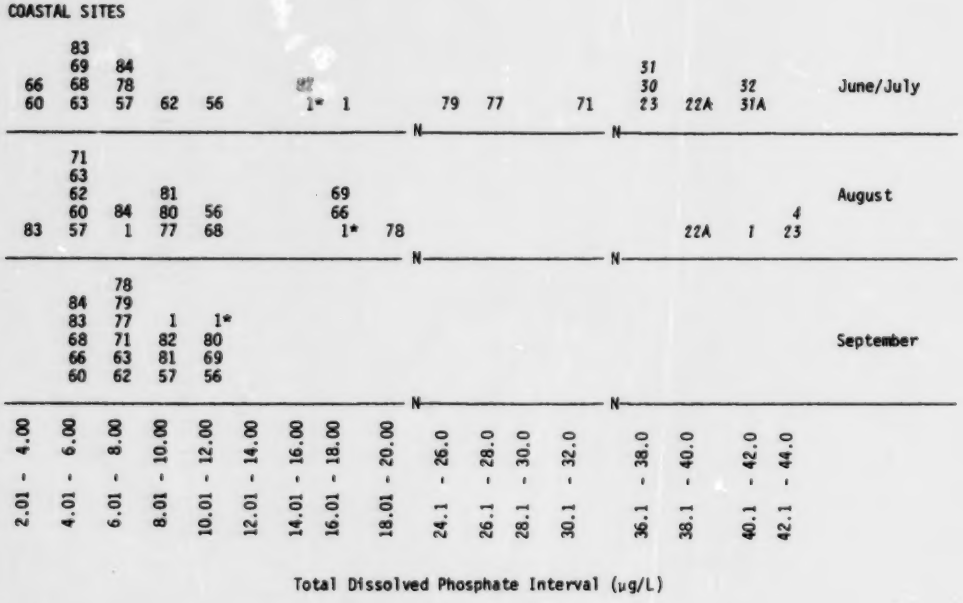


Fig. 7. Variability in surface TDP ($\mu g \cdot L^{-1}$) at coastal sites during the June/July, August and September surveys of 1979 and 1980 (*012* = 1979, 012 = 1980).

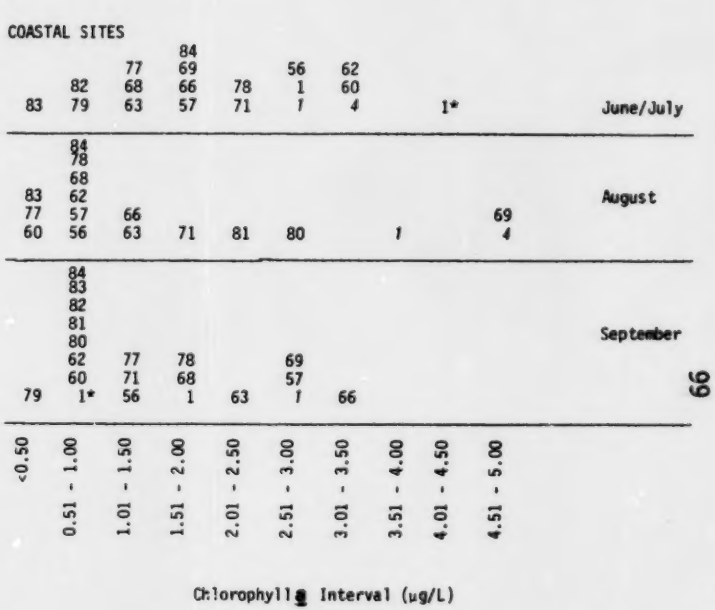


Fig. 8. Variability in surface chlorophyll a ($\mu g \cdot L^{-1}$) at coastal sites during the June/July, August and September survyes of 1979 and 1980 (*012* = 1979, 012 = 1980).

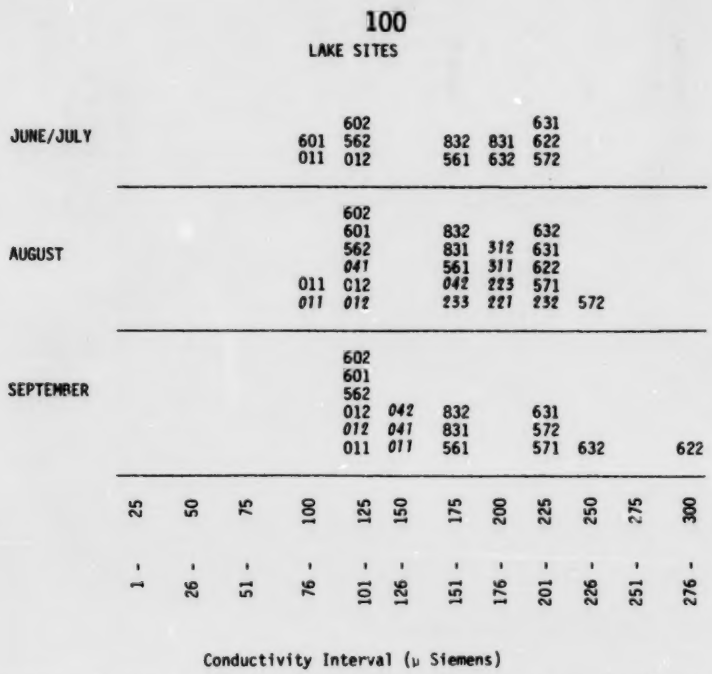


Fig. 9. Variability in surface conductivity (μSiemens) of lakes during the June/July, August and September surveys of 1979 and 1980 (*012* = 1979, 012 = 1980).

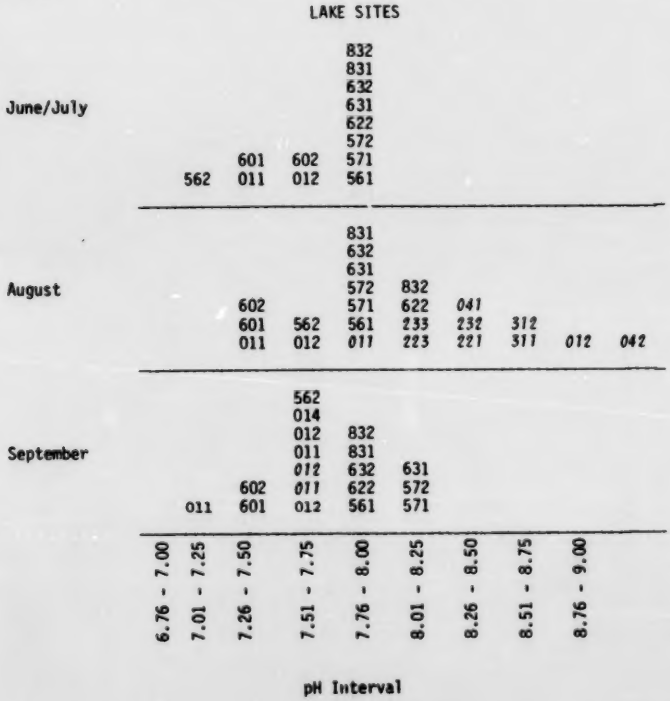


Fig. 10. Variability in surface pH of lakes during the June/July, August and September surveys of 1978-1980 (012 = 1978, *012* = 1979, 012 = 1980).

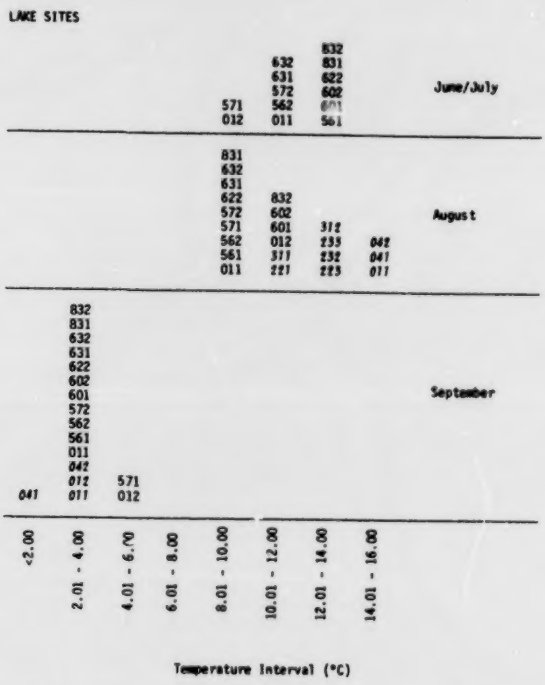


Fig. 11. Variability in surface water temperature (°C) of lakes during the June/July, August and September surveys of 1979 and 1980 (*012* = 1979, 012 = 1980).

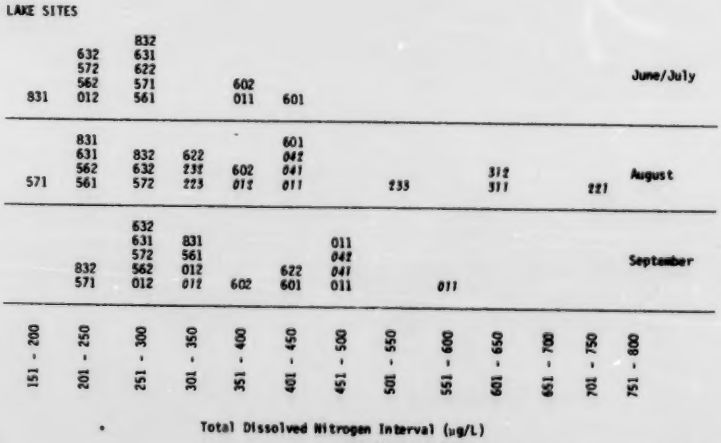


Fig. 12. Variability in surface TDN (µg L^{-1}) of lakes during the June/July, August and September surveys of 1979 and 1980 (*012* = 1979, 012 = 1980).

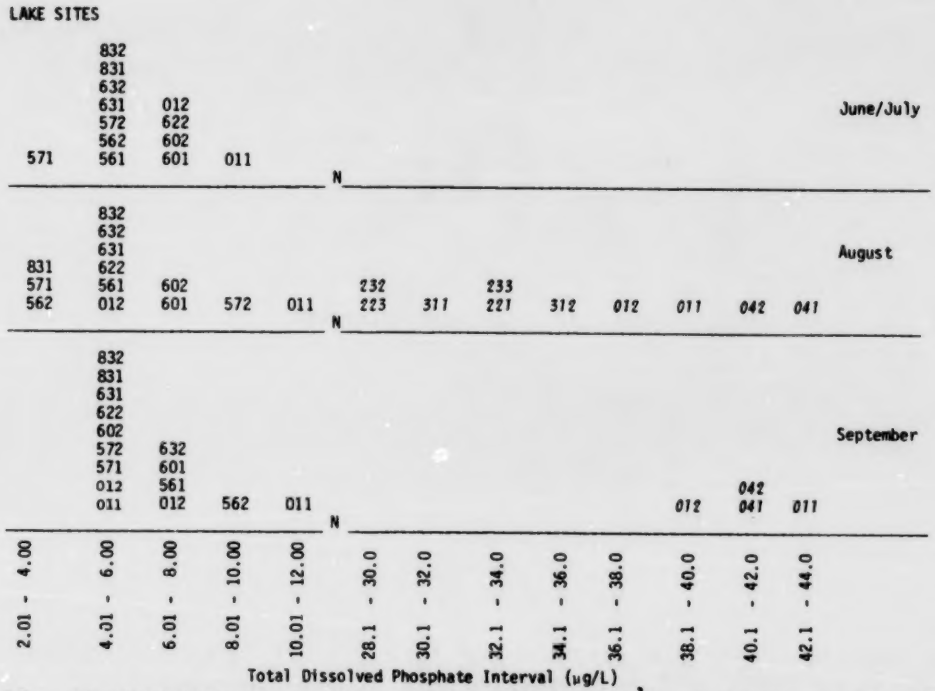


Fig. 13. Variability in surface water TDP (µg L^{-1}) of lakes during the June/July, August and September surveys of 1979 and 1980 (*012* = 1979, 012 = 1980).

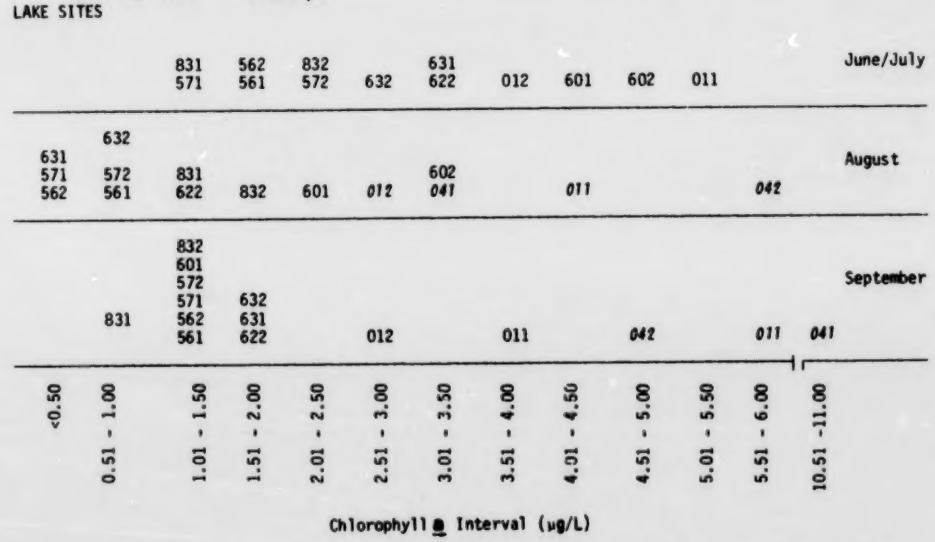


Fig. 14. Variability in surface chlorophyll a (µg L^{-1}) of lakes during the June/July, August and September surveys of 1979 and 1980 (*012* = 1979, 012 = 1980).

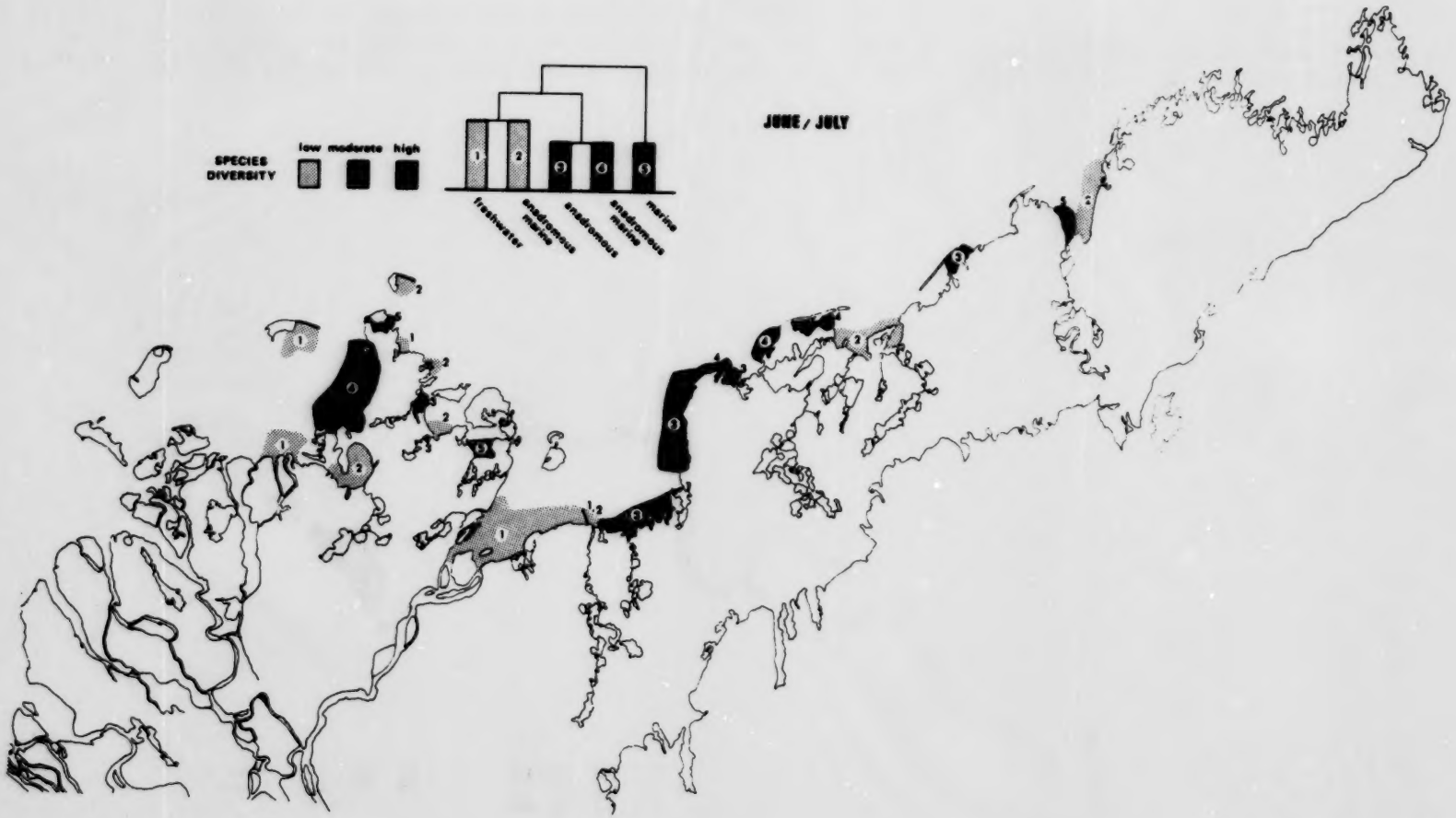


Fig. 15. Maps of June/July fish species' assemblages based on cluster analysis grouping of coastal gillnet catch data from Richards Island to Cape Dalhousie. Numbers refer to assemblage groups. (Refer to Table 10 for an explanation of group characteristics).

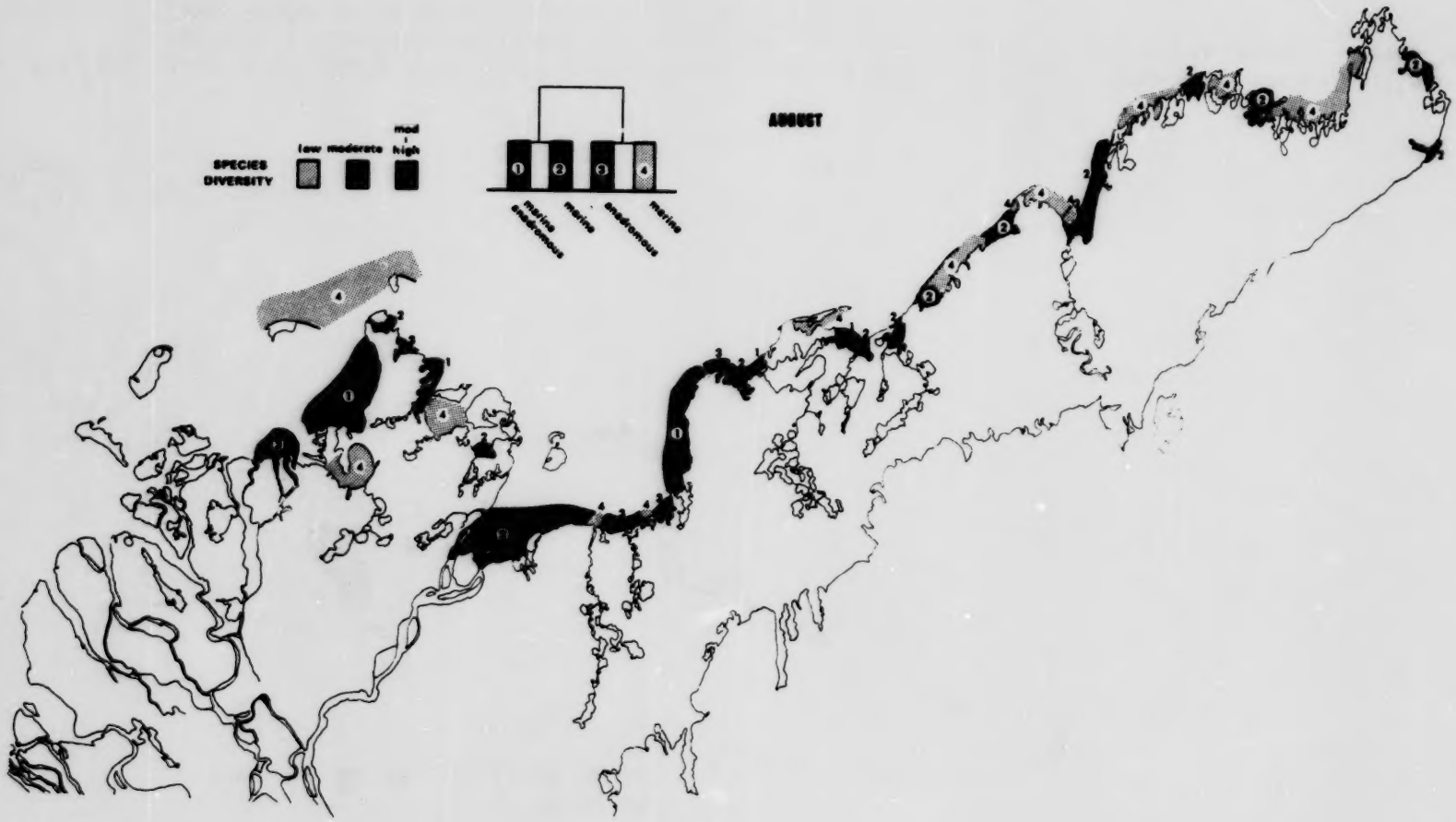


Fig. 16. Maps of August fish species' assemblages based on cluster analysis grouping of coastal gillnet catch data from Richards Island to Cape Dalhousie. Numbers refer to assemblage groups. (Refer to Table 10 for an explanation of group characteristics).

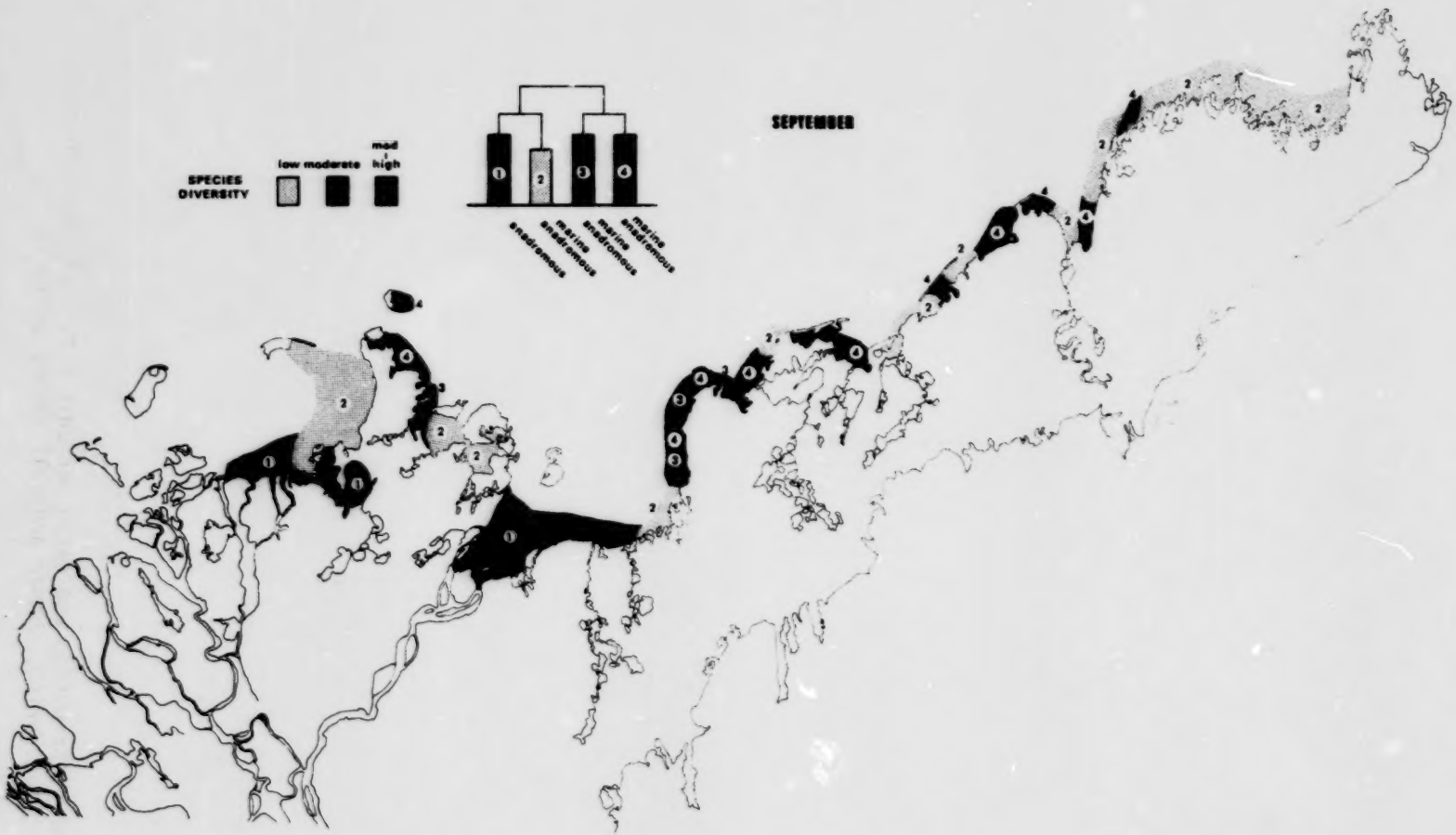


Fig. 17. Maps of September fish species' assemblages based on cluster analysis grouping of coastal gillnet catch data from Richards Island to Cape Dalhousie. Numbers refer to assemblage groups. (Refer to Table 10 for an explanation of group characteristics).

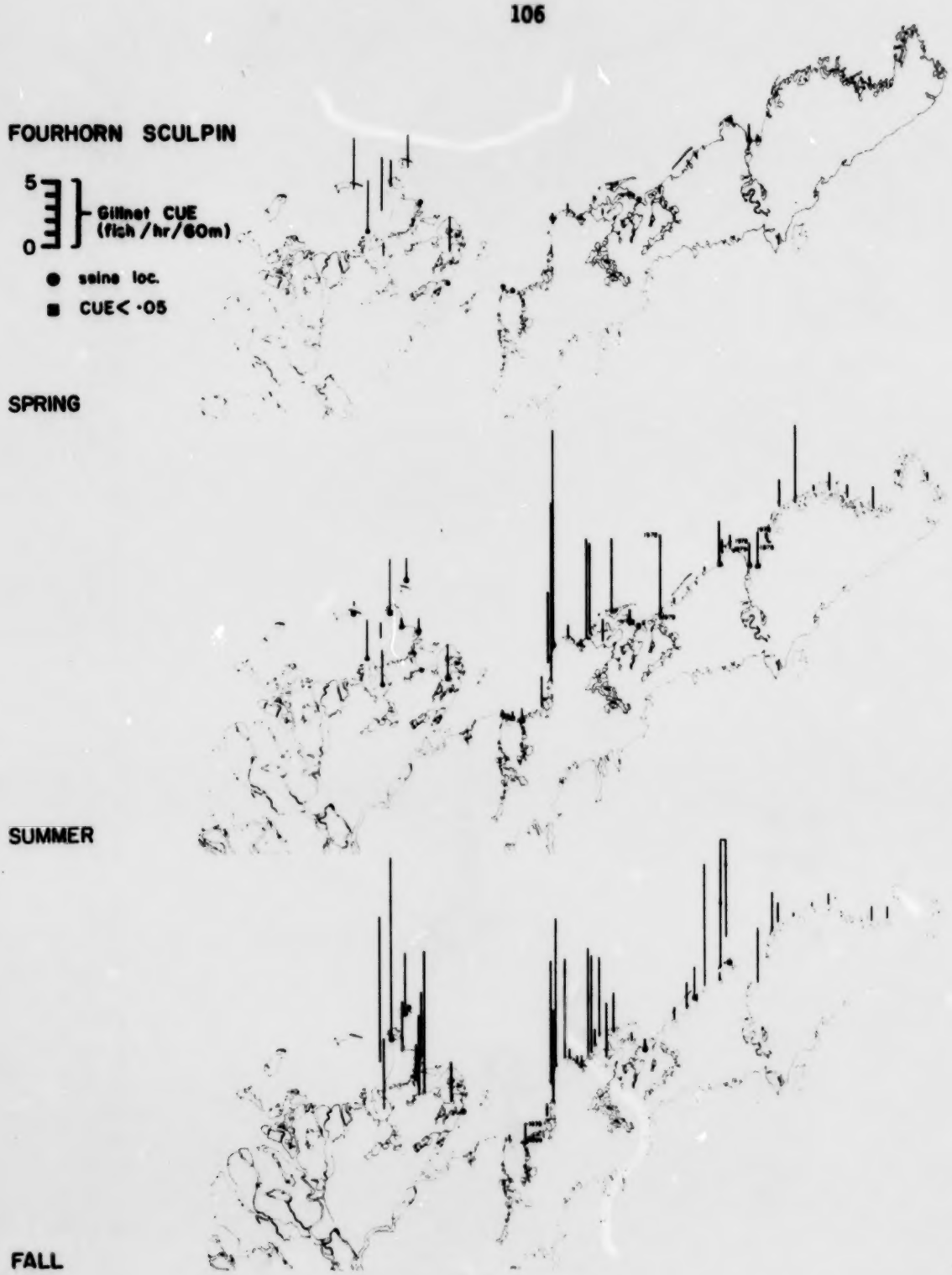


Fig. 18. Map of distribution and catch per unit effort of fourhorn sculpin during the spring, summer and fall survey periods.

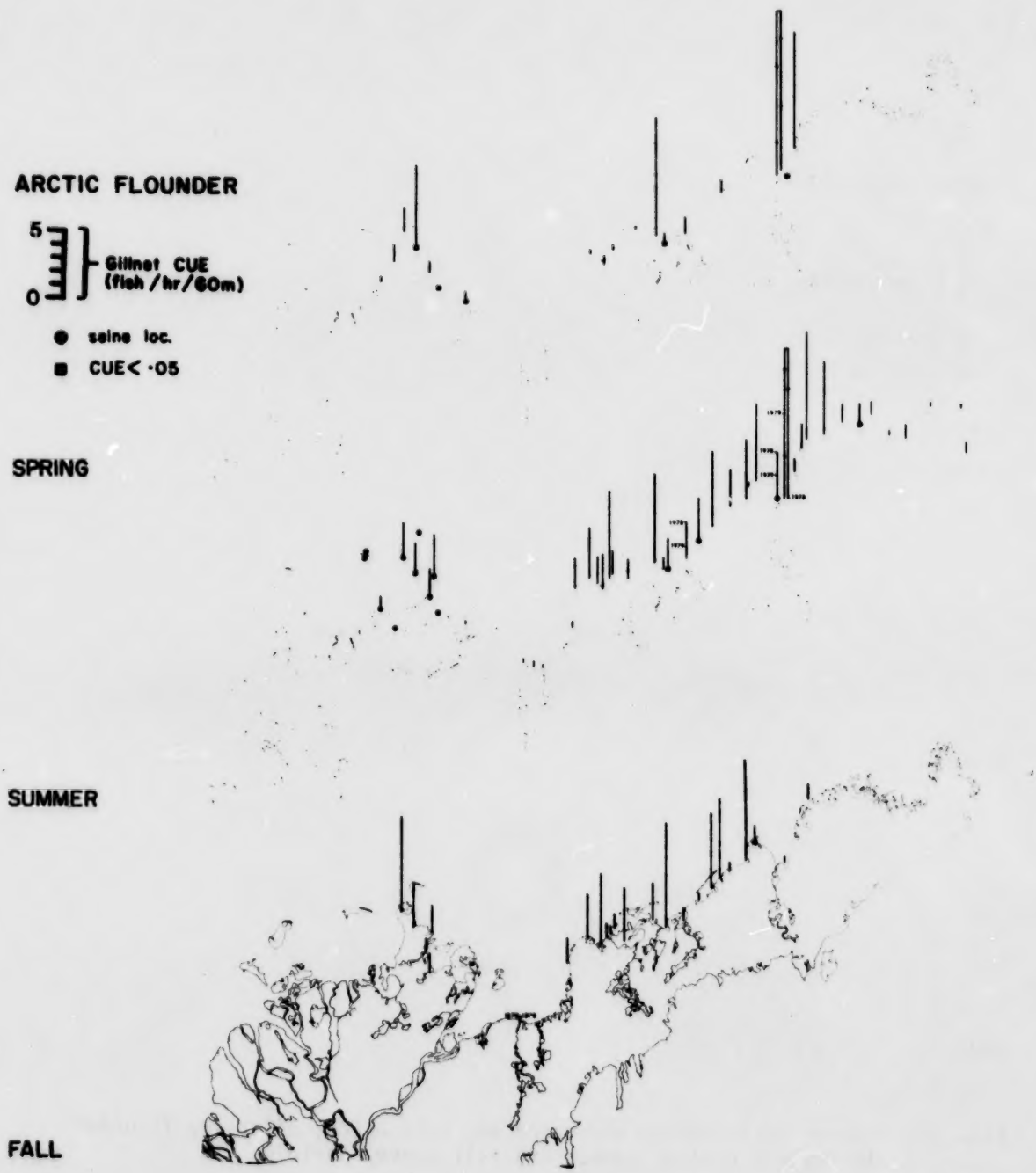


Fig. 19. Map of distribution and catch per unit effort of Arctic flounder during the spring, summer and fall survey periods.

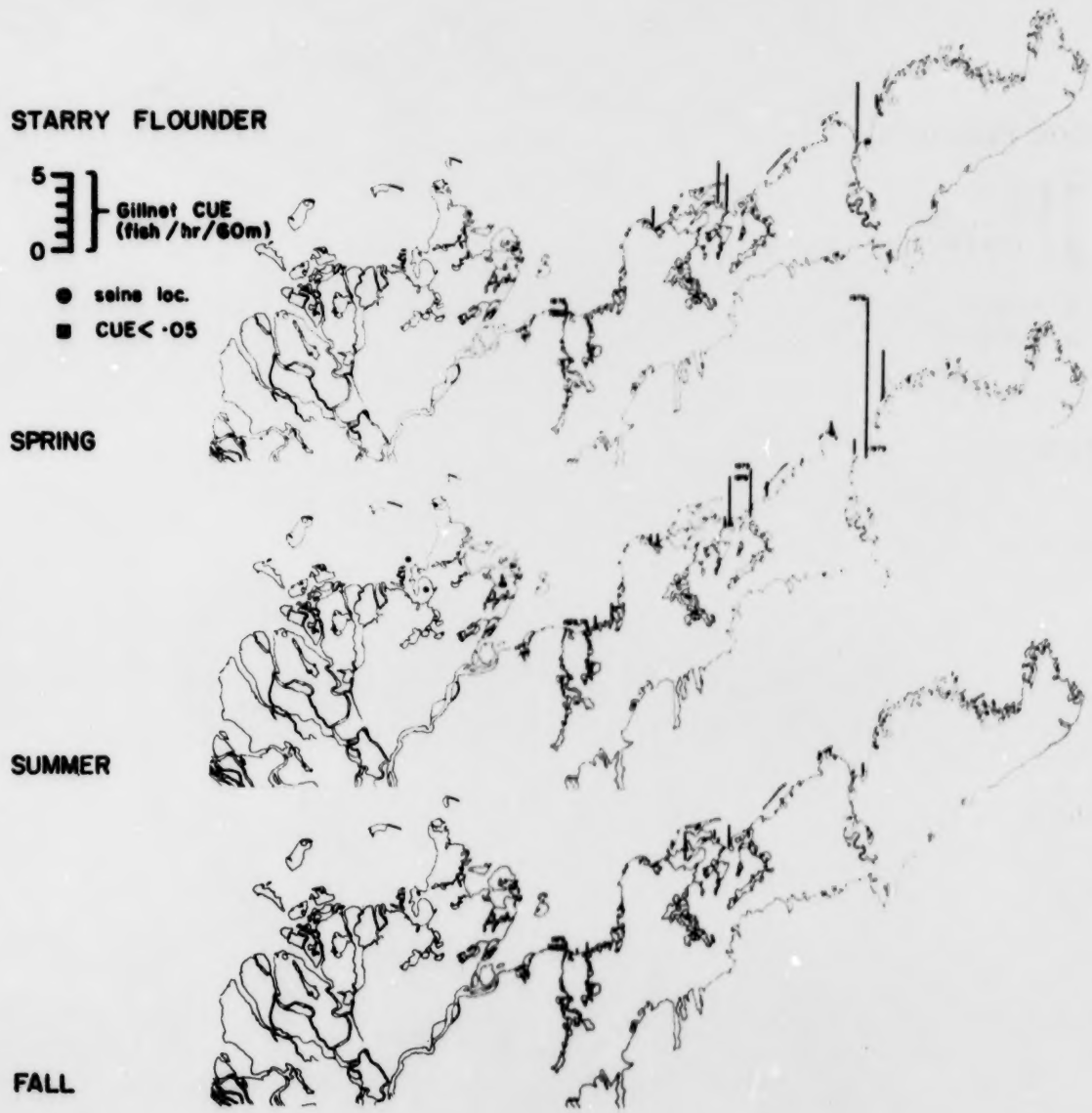


Fig. 20. Map of distribution and catch per unit effort of starry flounder during the spring, summer and fall survey periods.

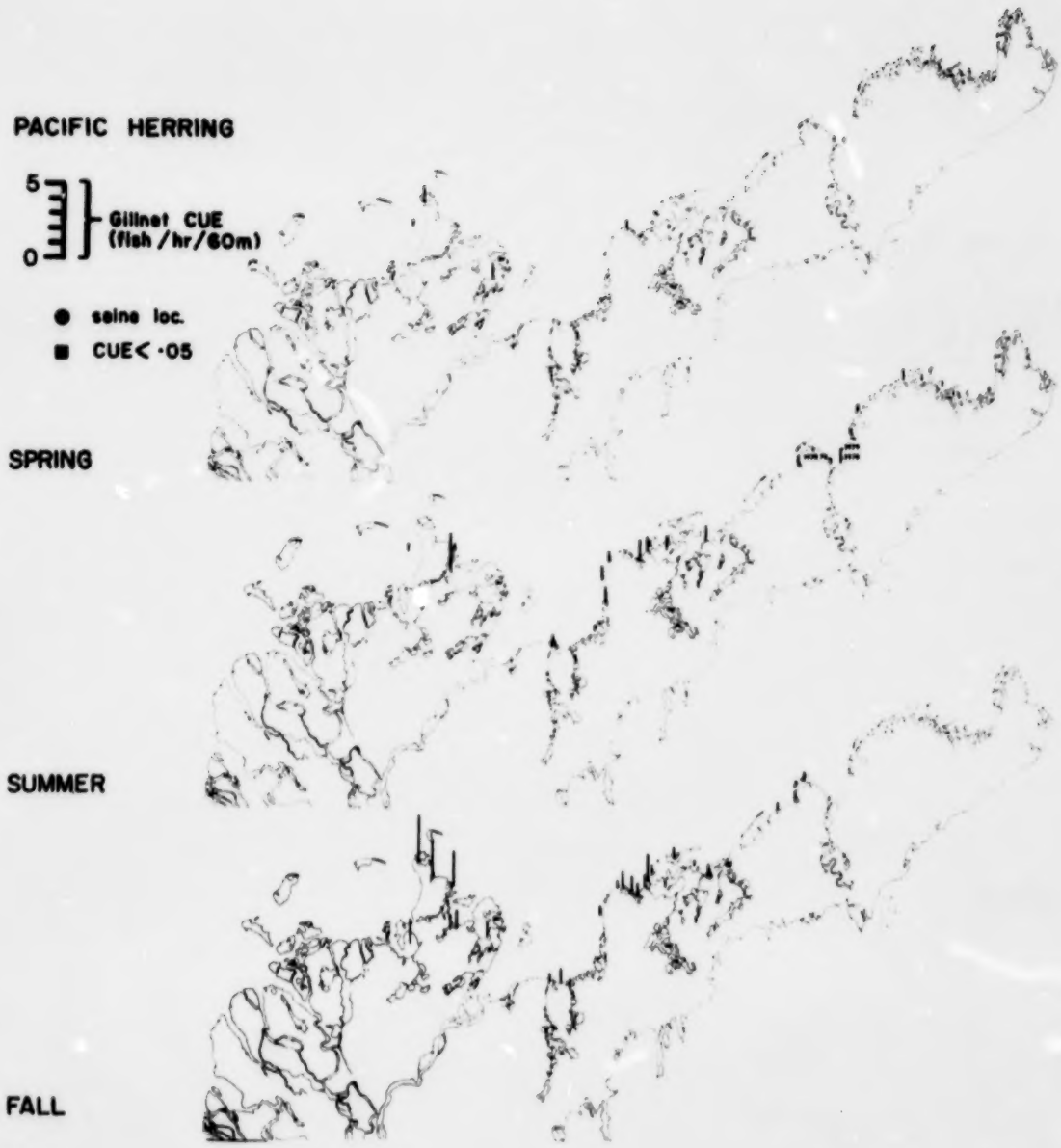


Fig. 21. Map of distribution and catch per unit effort of Pacific herring during the spring, summer and fall survey periods.

Fig. 22. Map of distribution and catch per unit effort of saffron cod during the spring, summer and fall survey periods.

Fig. 23. Map of distribution and catch per unit effort of Arctic cisco during the spring, summer and fall survey periods.

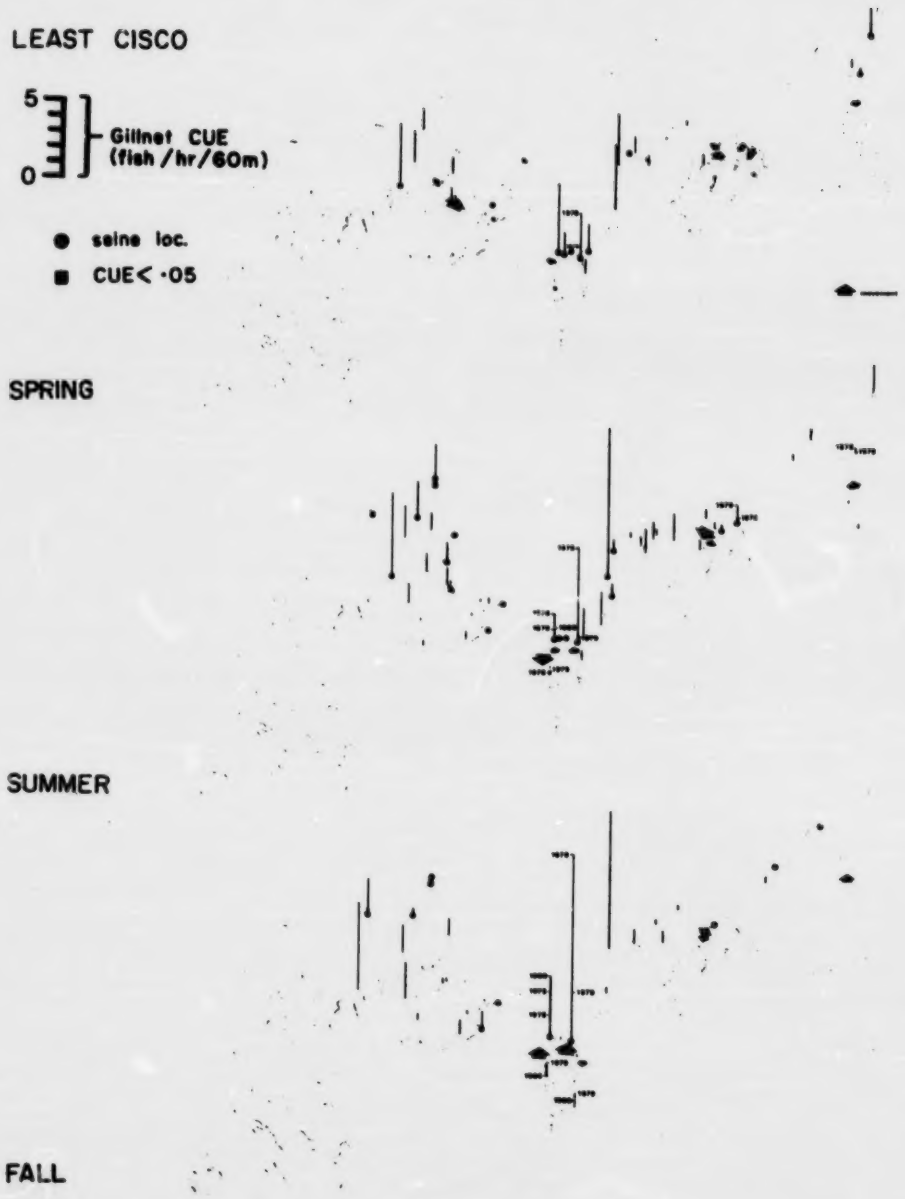


Fig. 24. Map of distribution, catch per unit effort and stream migration of least cisco during the spring, summer and fall survey periods.

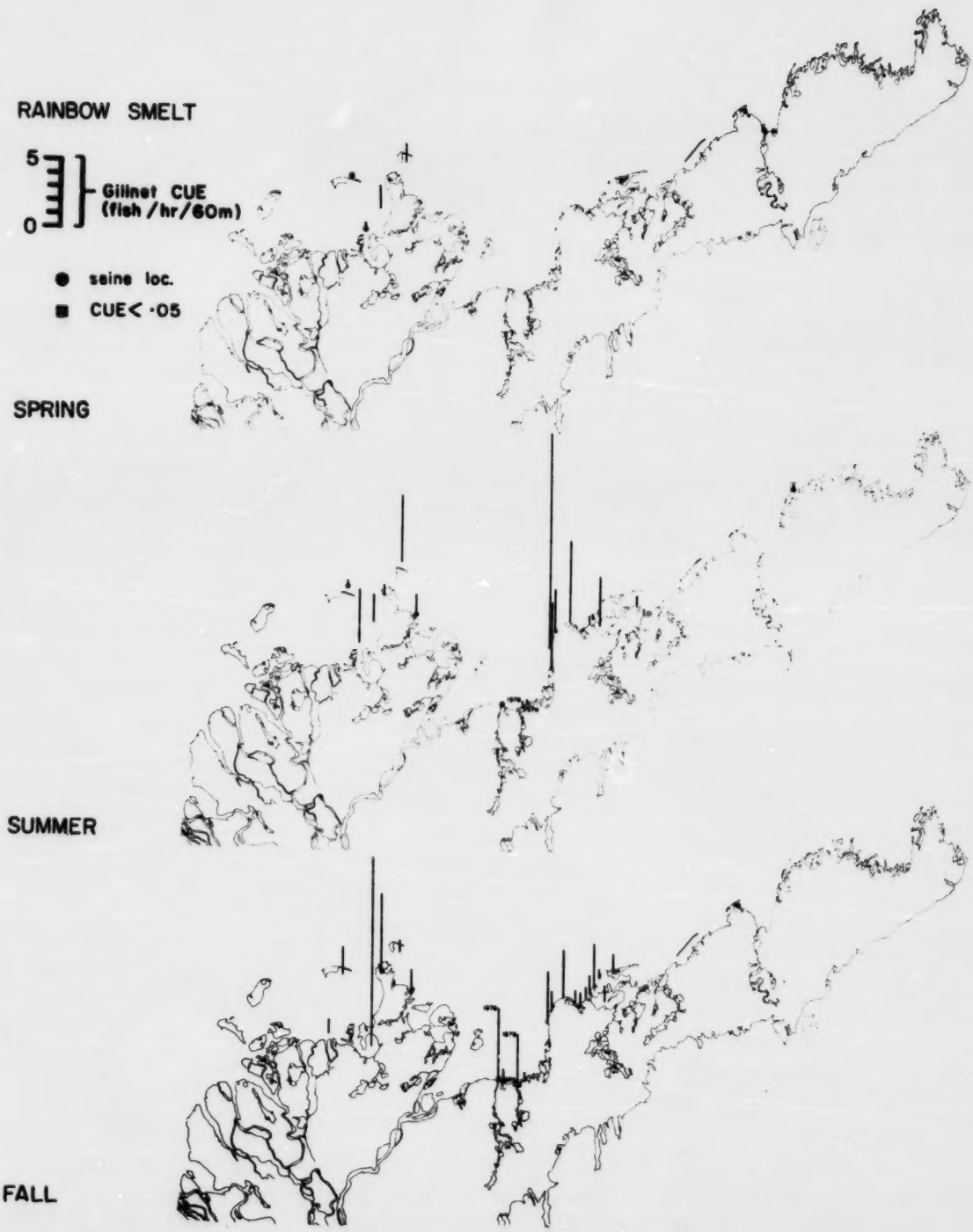


Fig. 25. Map of distribution and catch per unit effort of rainbow smelt during the spring, summer and fall survey periods.

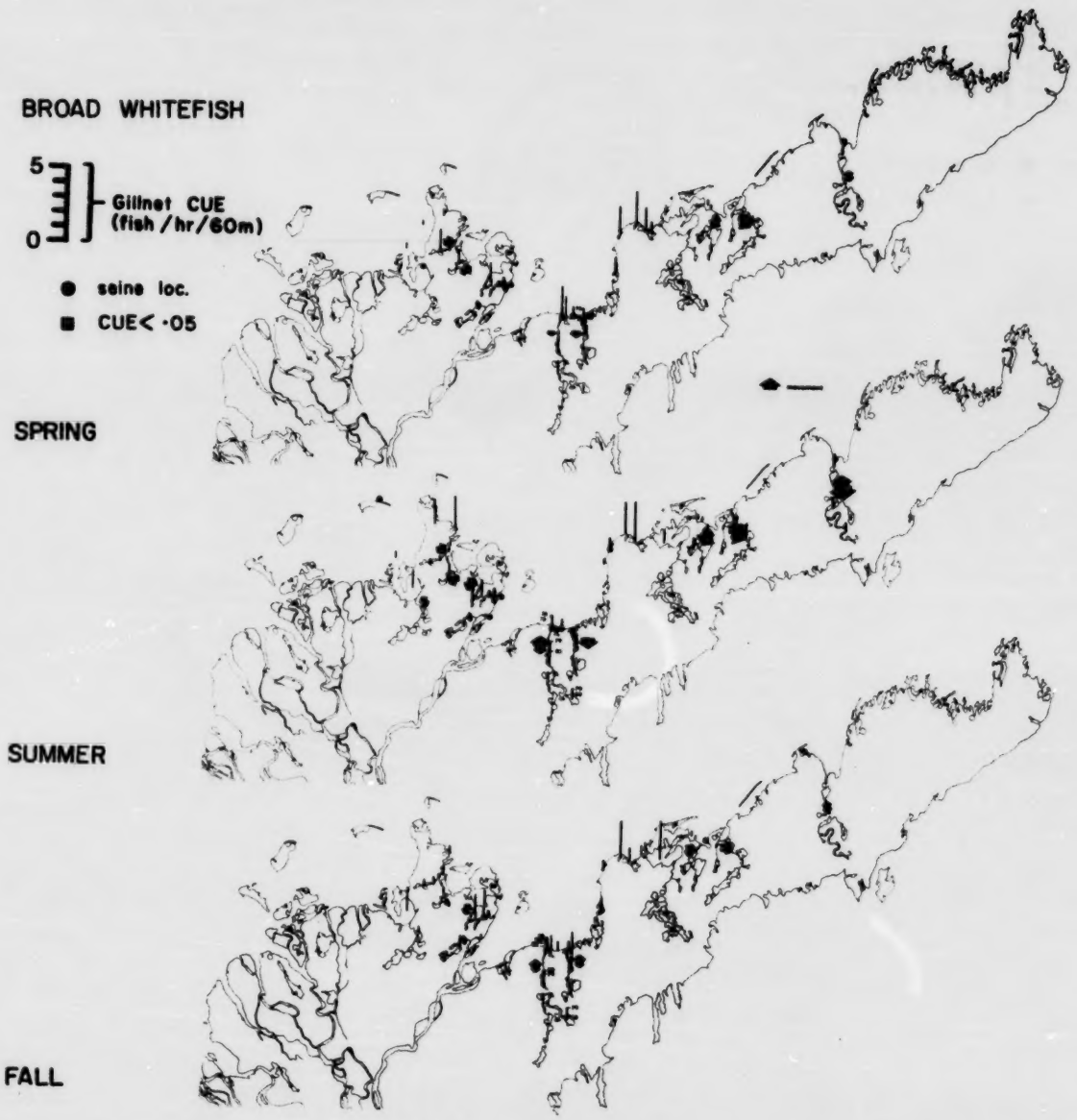


Fig. 26. Map of distribution and catch per unit effort and stream migration of broad whitefish during the spring, summer and fall survey periods.

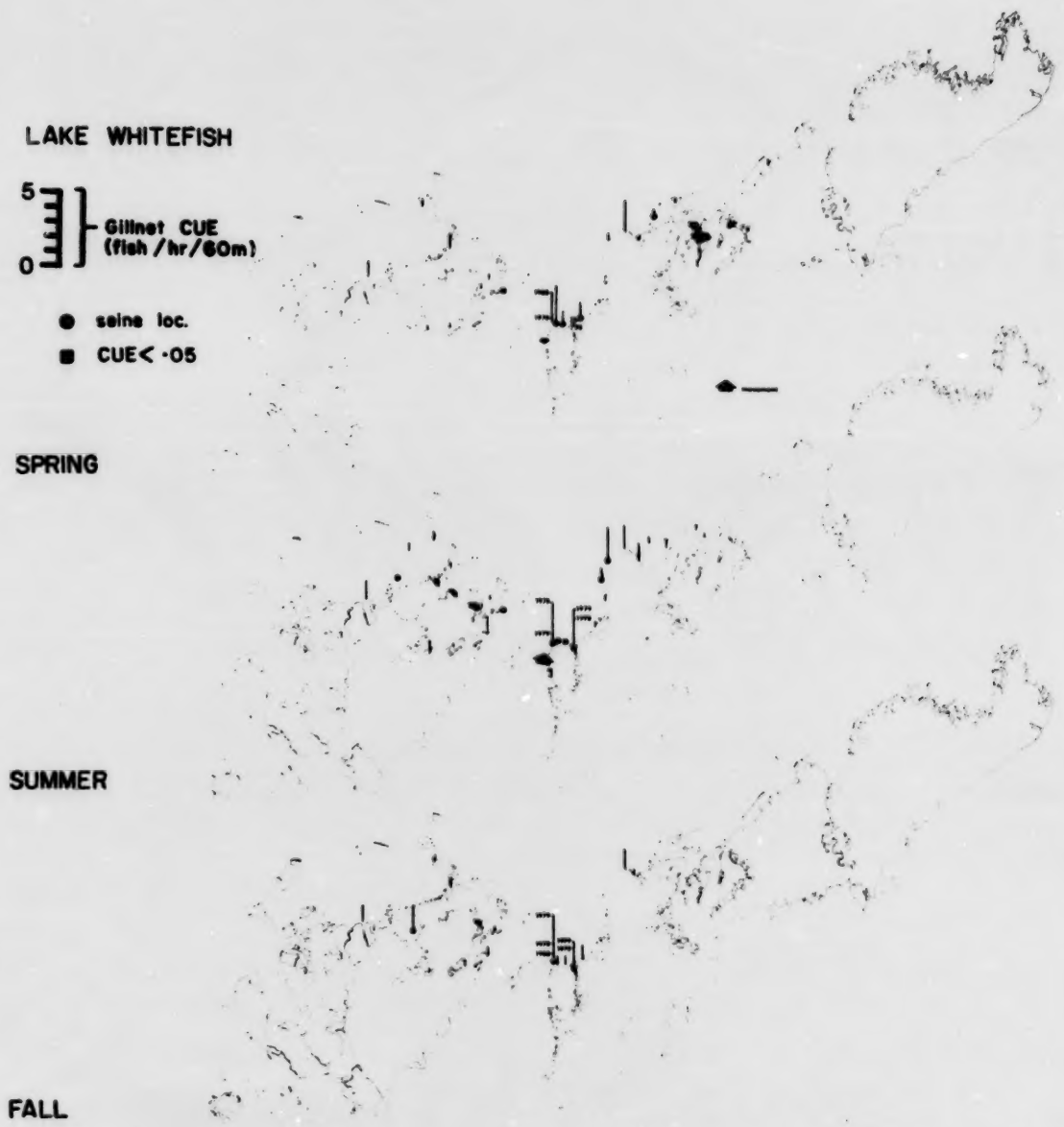


Fig. 27. Map of distribution and catch per unit effort and stream migration of lake whitefish during the spring, summer and fall survey periods.

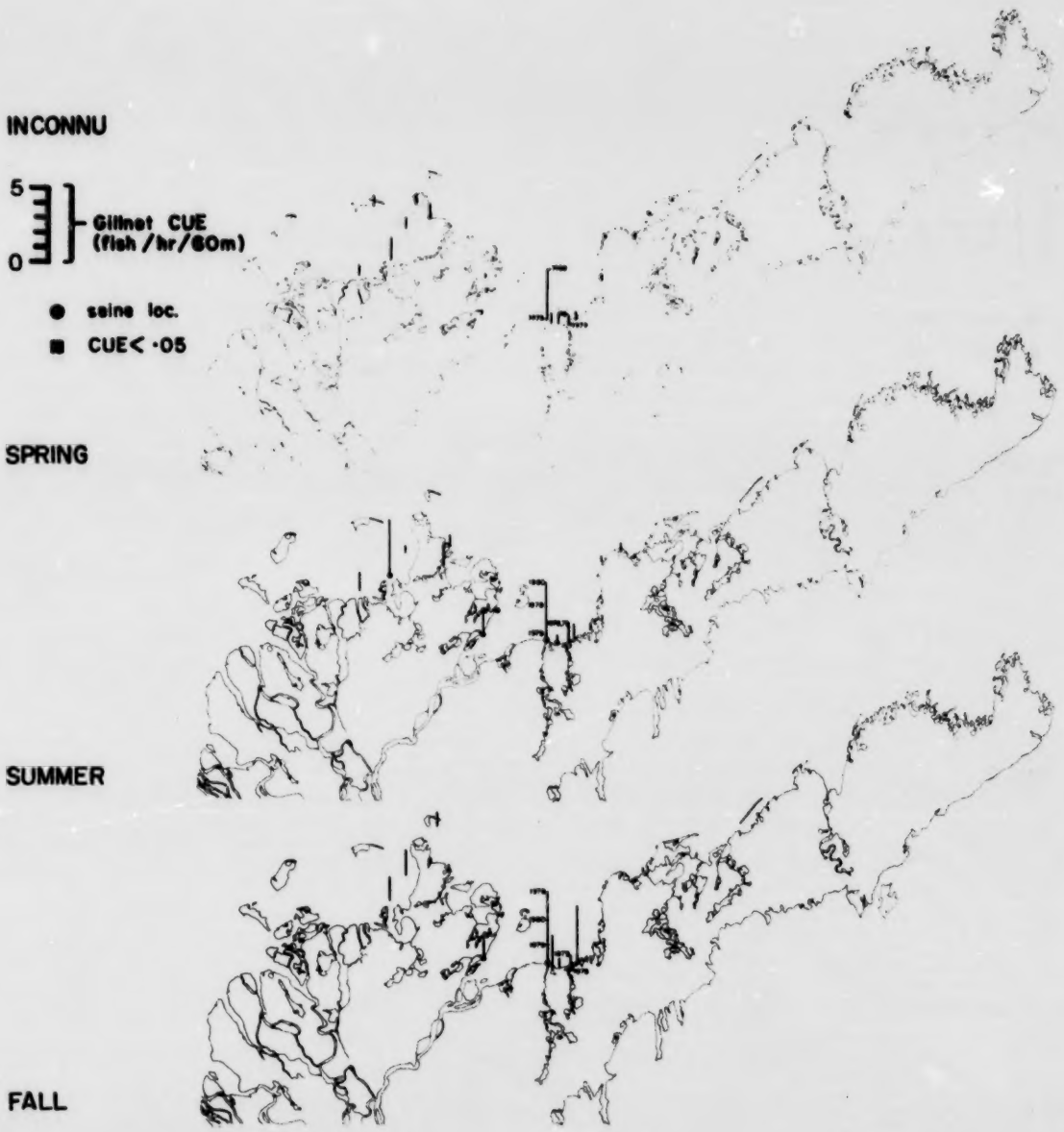


Fig. 28. Map of distribution and catch per unit effort of inconnu during the spring, summer and fall survey periods.

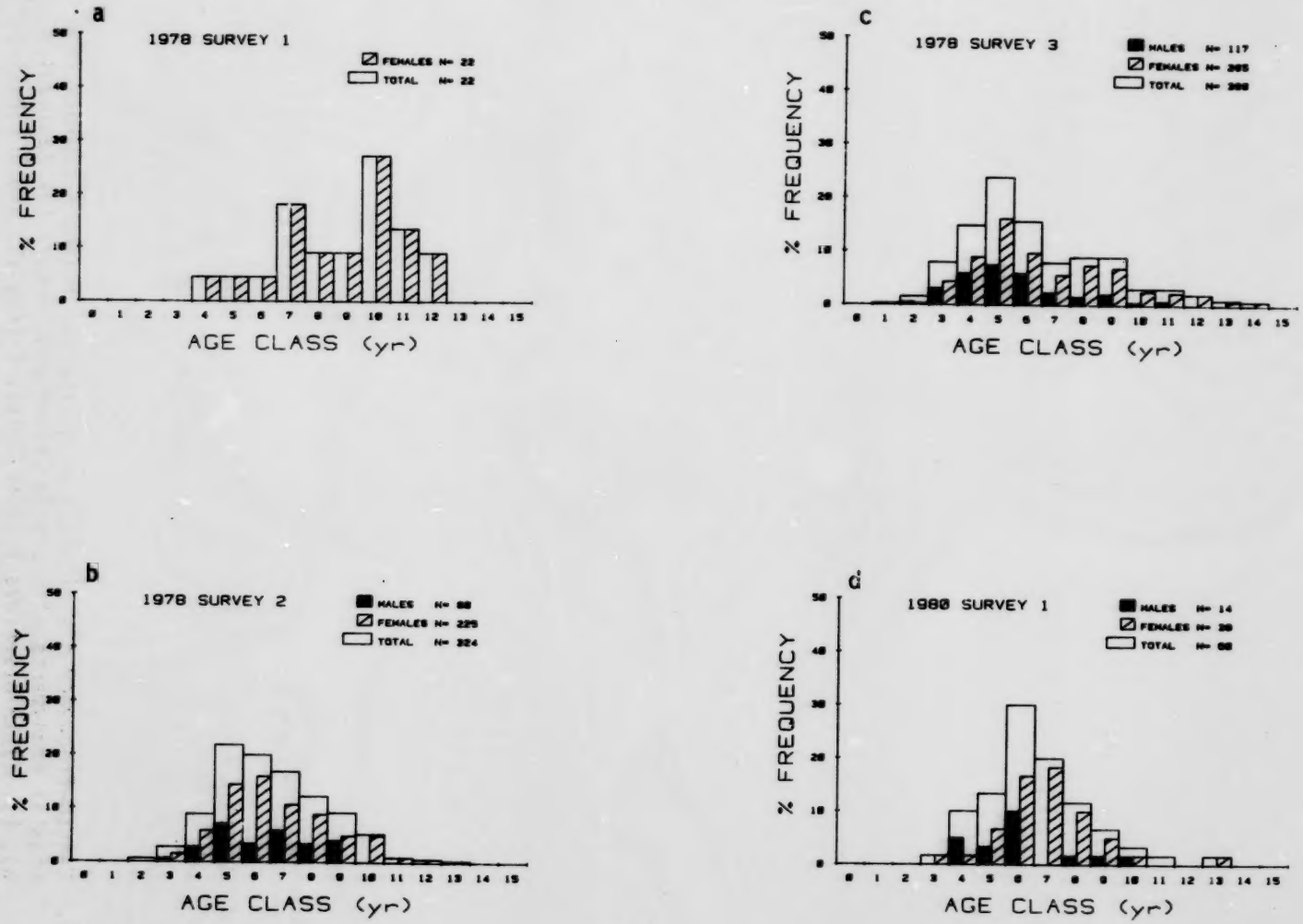


Fig. 29. Age-frequency distribution of gillnetted fourhorn sculpin from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) 1978 surveys 1 (June/July), 2 (August) and 3 (September) respectively; d) 1980 survey 1 (June/July).

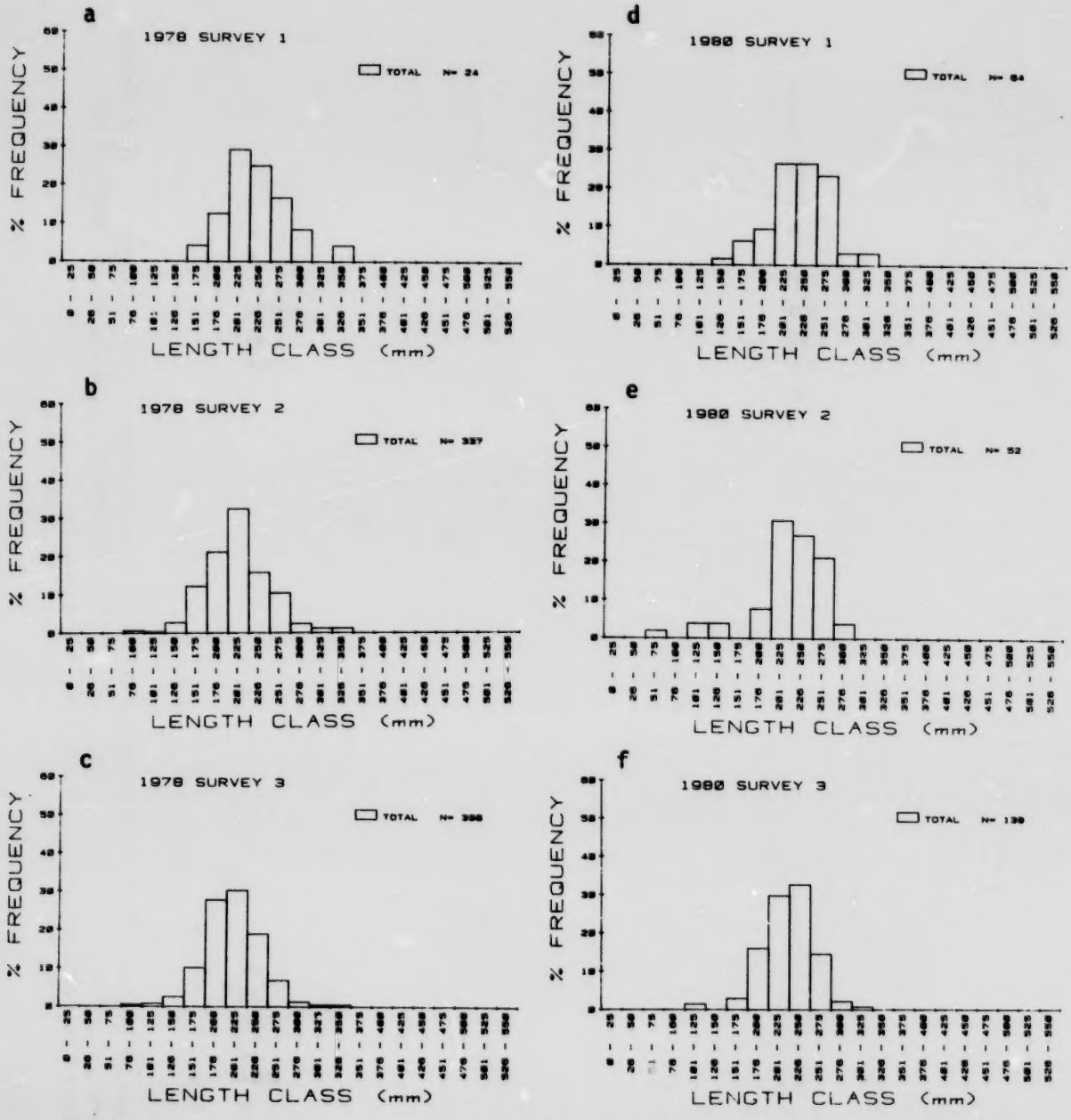


Fig. 30. Length-frequency distribution of gillnetted fourhorn sculpin from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) 1978 surveys 1 (June/July), 2 (August) and 3 (September) respectively; d), e), f) 1980 surveys 1 (June/July, 2, (August) and 3 (September) respectively.

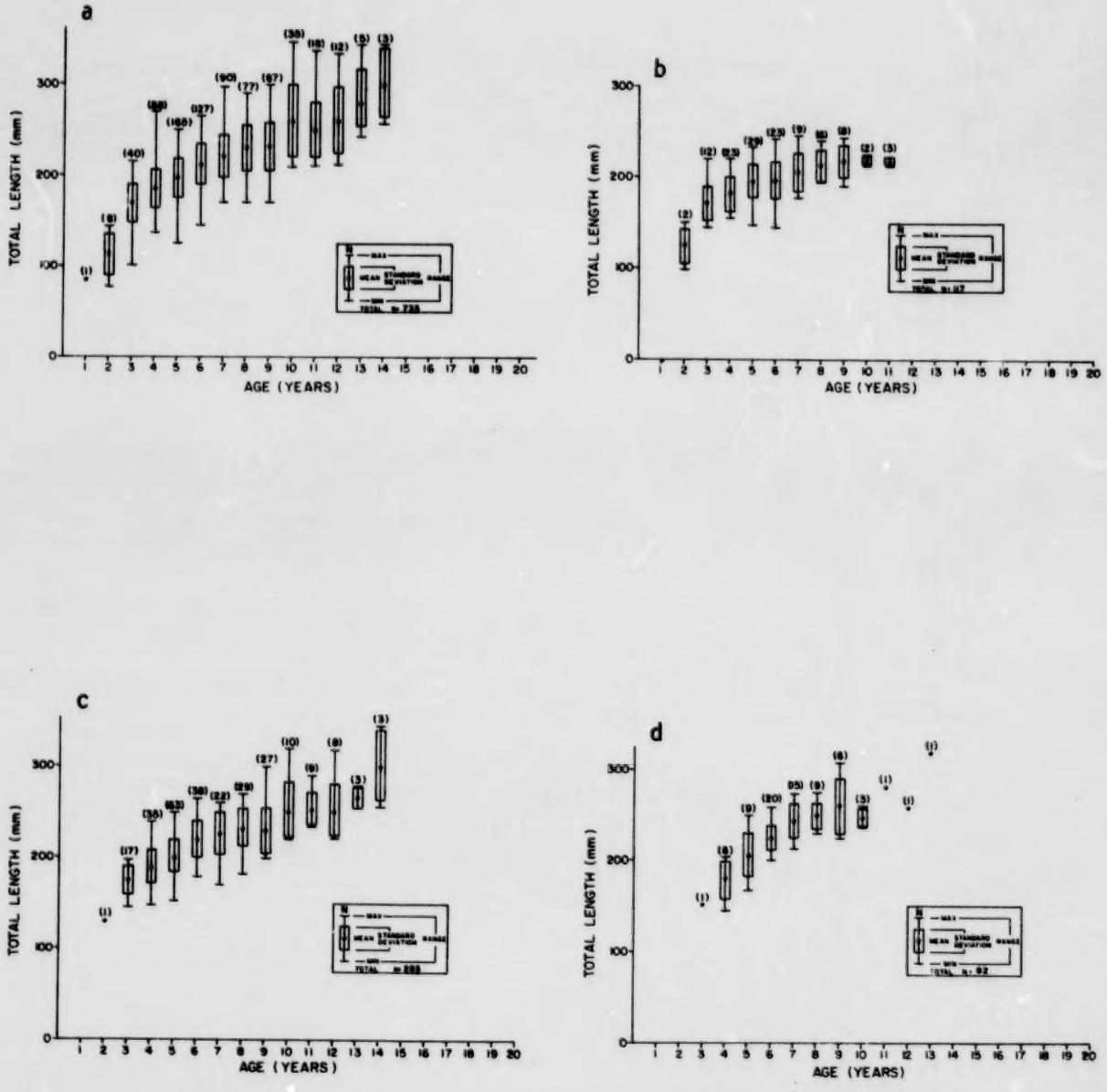
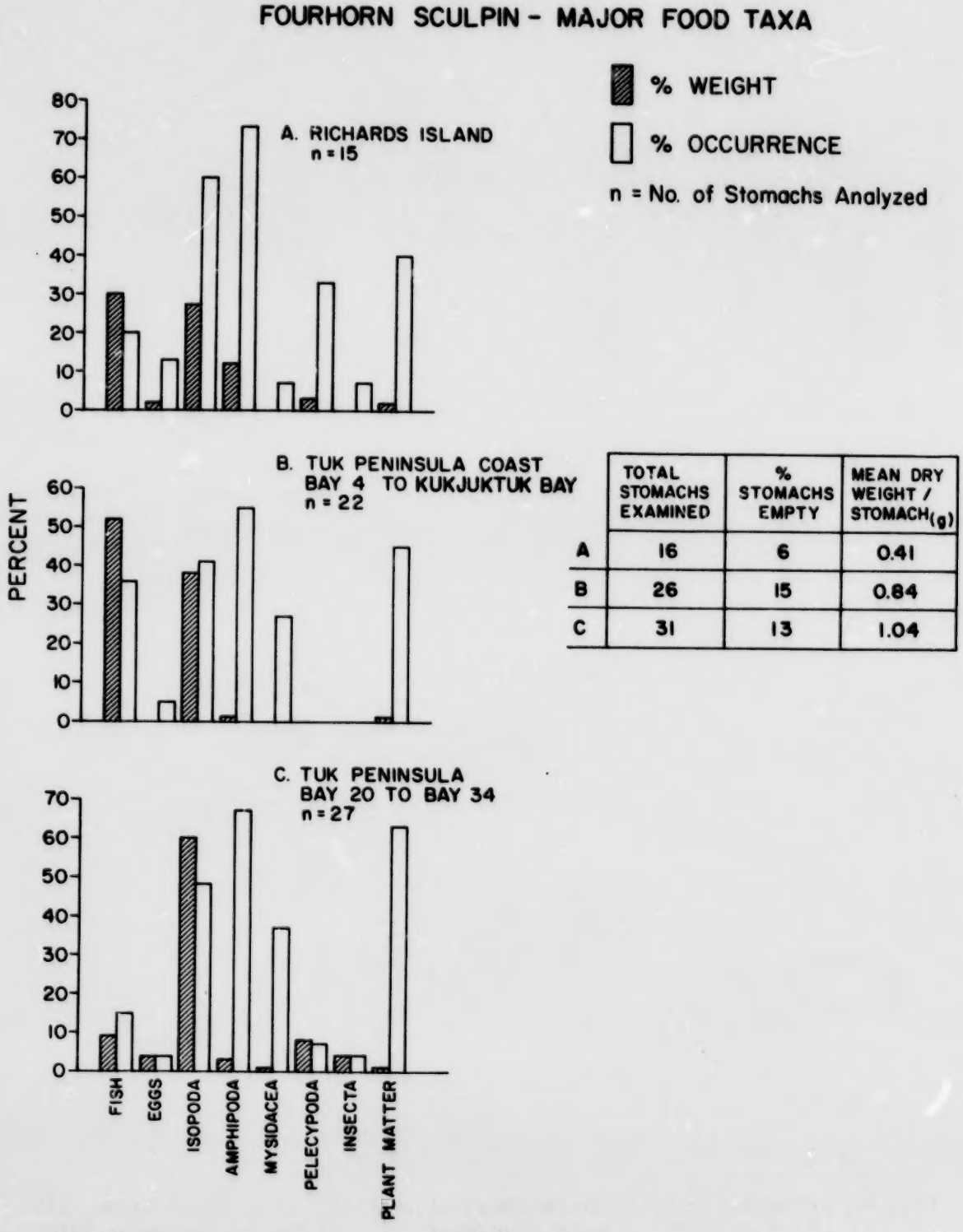


Fig. 31. Fourhorn sculpin age-length relationships: a) combined sexes, all surveys 1978; b) males, September 1978; c) females September 1978; d) combined sexes, all surveys, 1980.



	TOTAL STOMACHS EXAMINED	% STOMACHS EMPTY	MEAN DRY WEIGHT / STOMACH$_{(g)}$
A	16	6	0.41
B	26	15	0.84
C	31	13	1.04

Fig. 32. Diet of fourhorn sculpin captured between late June and mid-September 1978-1980, as revealed by analysis of stomachs from three coastal areas of southeastern Beaufort Sea.

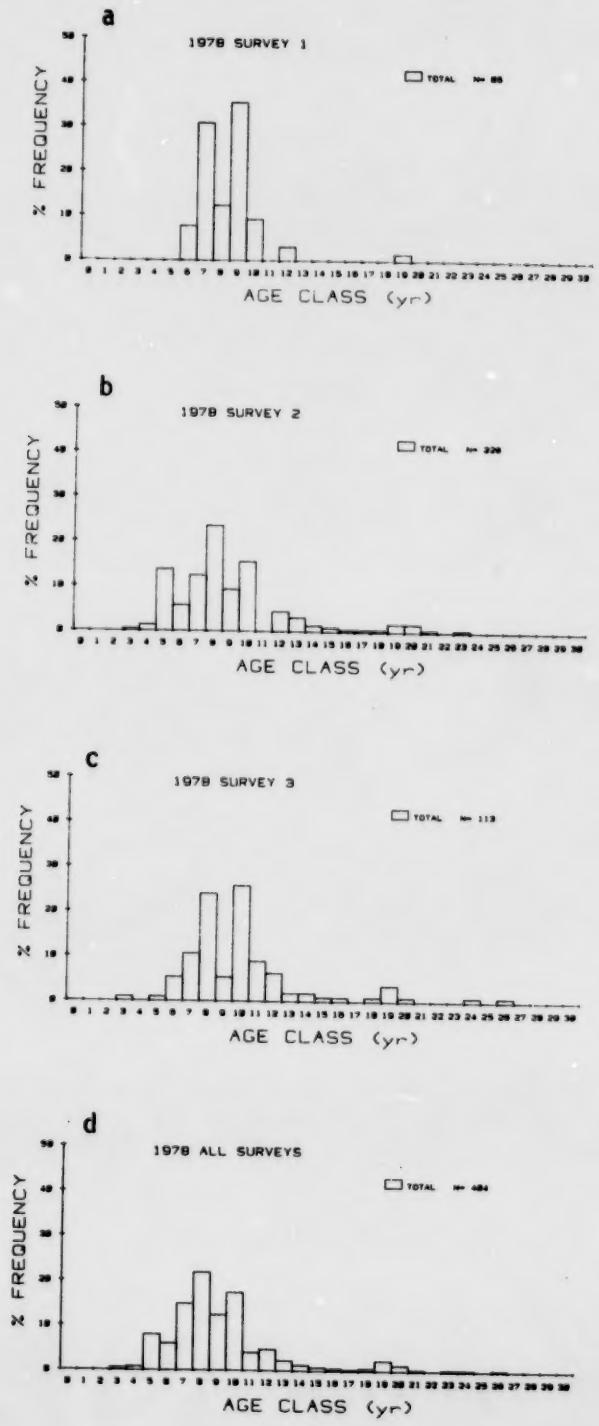


Fig. 33. Age-frequency distribution of gillnetted Arctic flounder from coastal embayments of Tuktoyaktuk Peninsula: a), b), c) 1978 surveys 1 (June/July), 2 (August), 3 (September) respectively; d) 1978 combined surveys data.

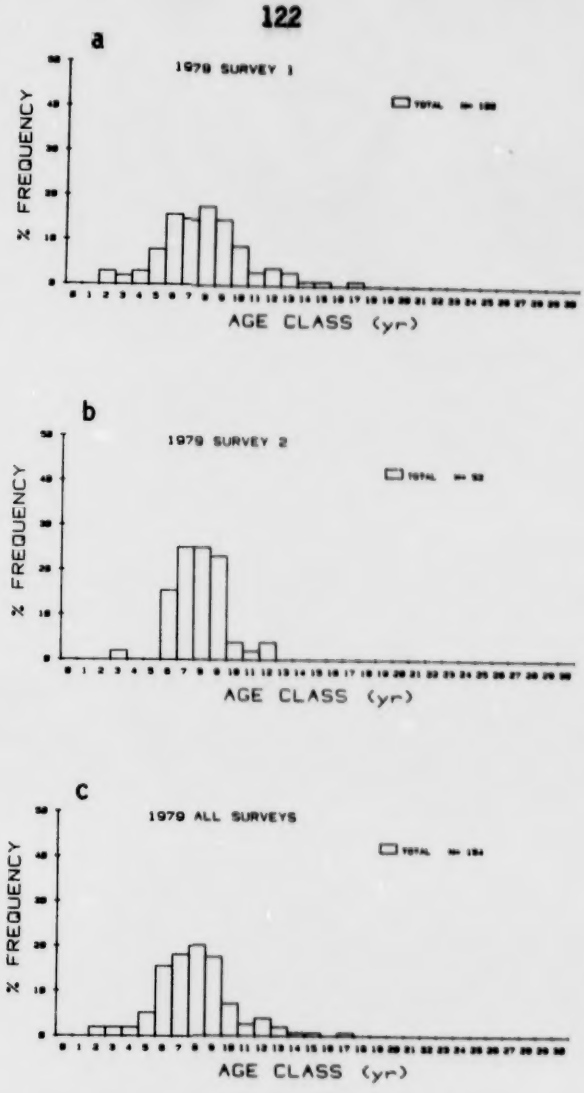


Fig. 34. Age-frequency distribution of gillnetted Arctic flounder from coastal embayments of Tuktoyaktuk Peninsula: a), b) 1979 surveys 1 (June/July), 2 (August) respectively; c) 1979 combined surveys data.

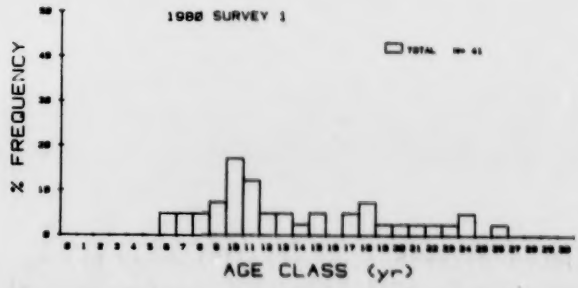


Fig. 35. Age-frequency distribution of gillnetted Arctic flounder from coastal embayments of Tuktoyaktuk Peninsula during survey 1 (June/July) 1980.

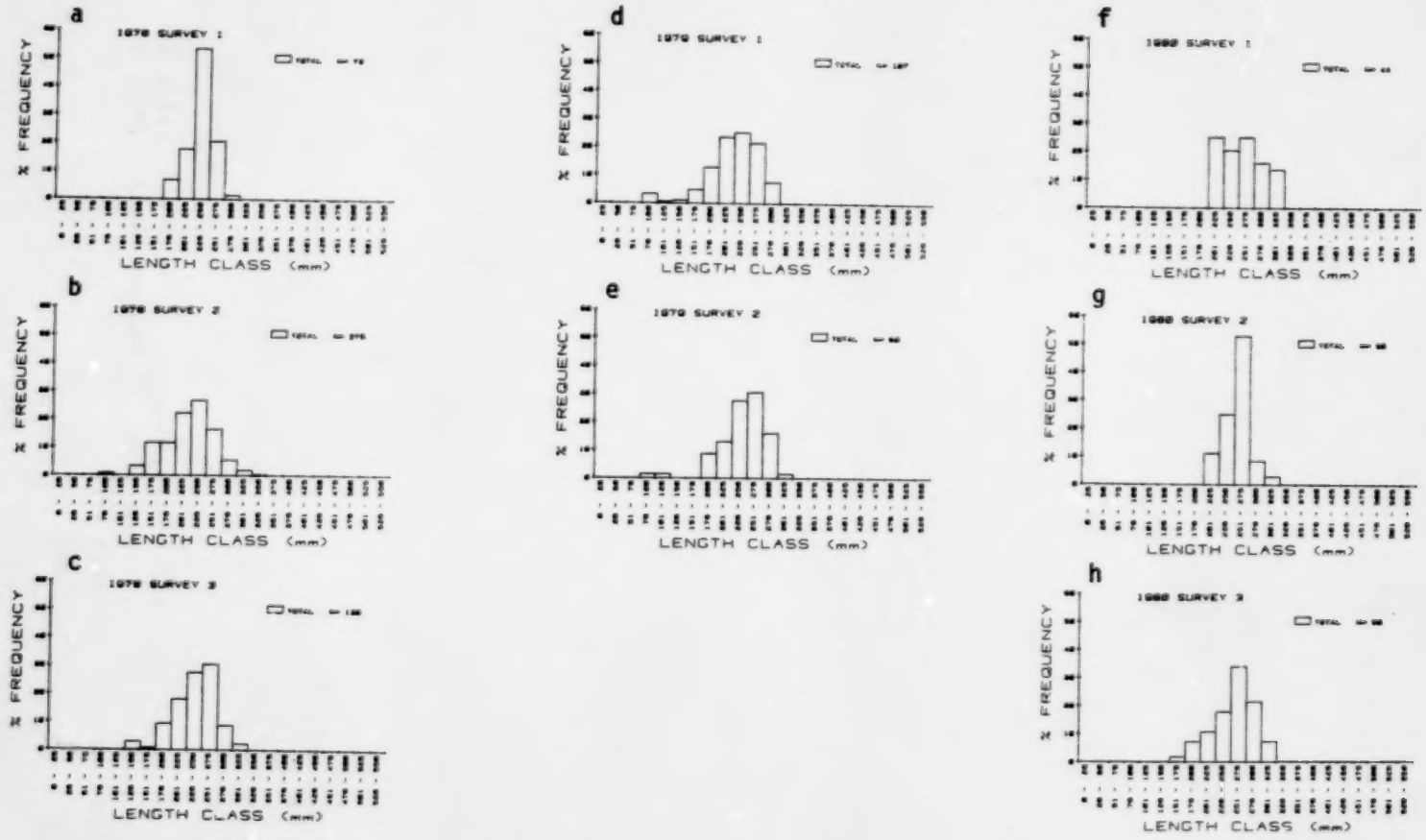


Fig. 36 Length-frequency distribution of gillnetted Arctic flounder from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) 1978 surveys 1 (June/July), 2 (August) and 3 (September) respectively; d), e) 1979 surveys 1 (June/July) and 2 (August); f), g), h) 1980 surveys 1 (June/July), 2 (August) and 3 (September) respectively.

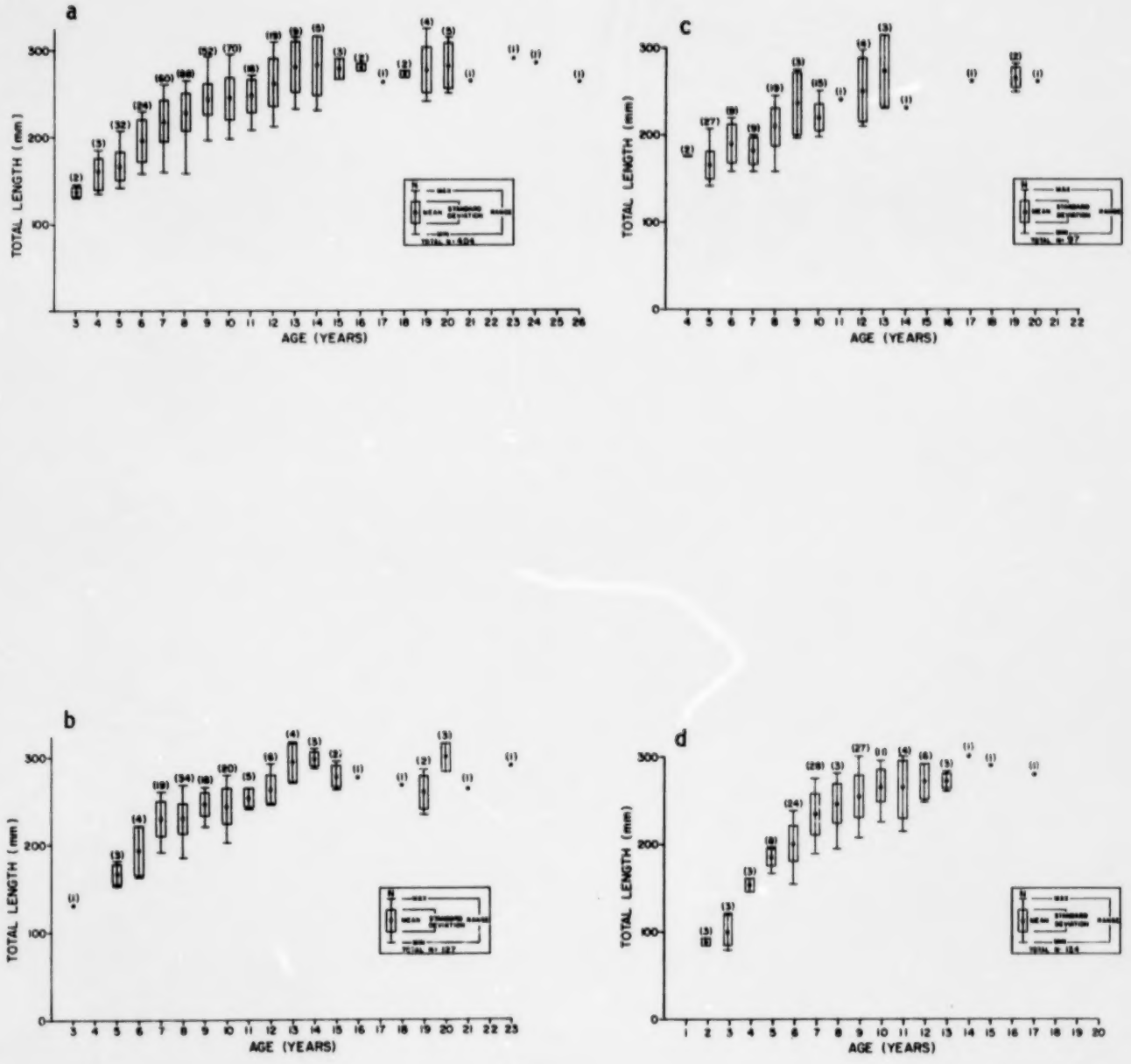
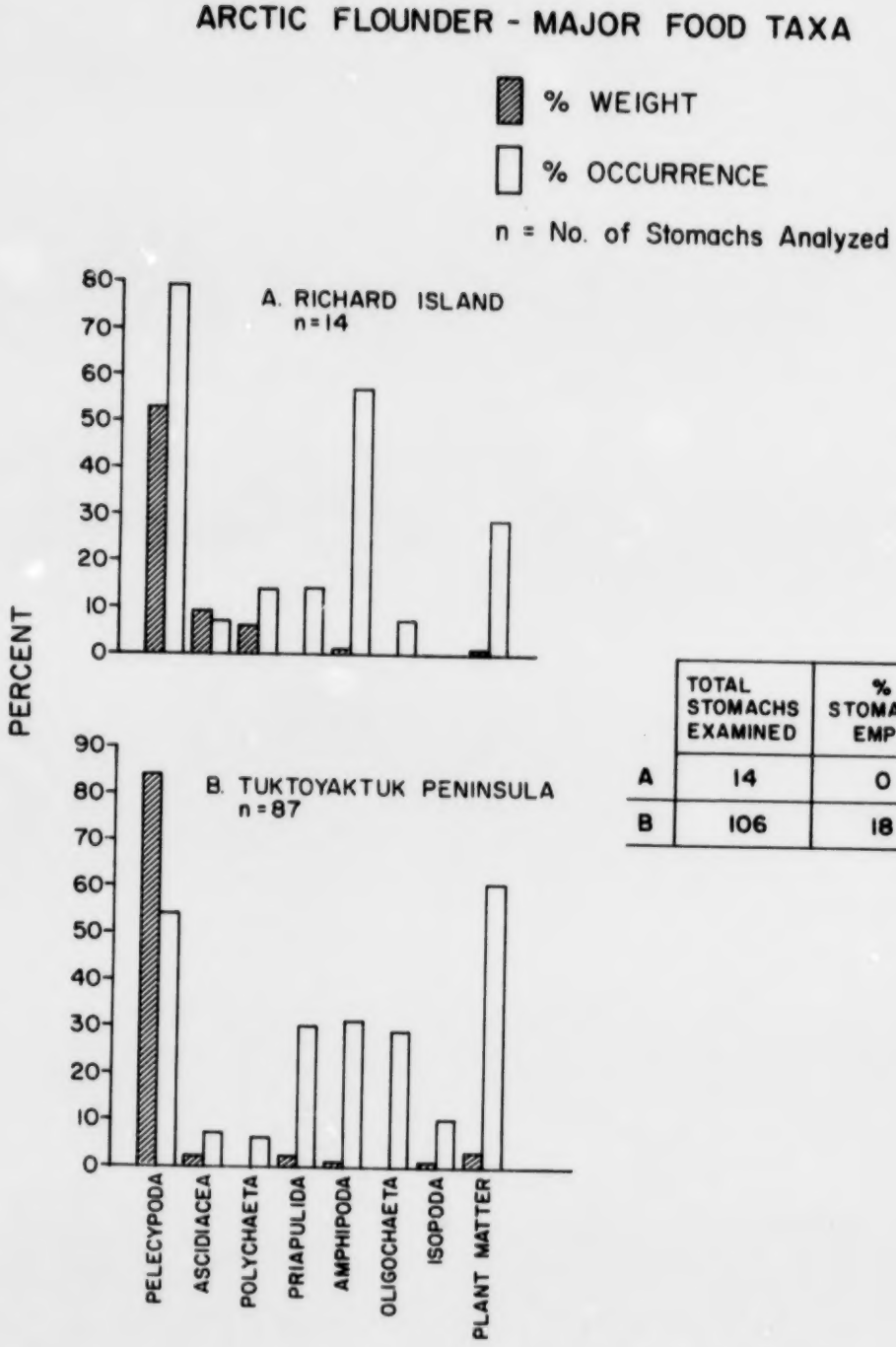


Fig. 37. Arctic flounder age-length relationships: a) combined sexes, all surveys 1978; b) males, August 1978; c) females, August 1978; d) combined sexes, all surveys 1979.



	TOTAL STOMACHS EXAMINED	% STOMACHS EMPTY	MEAN DRY WEIGHT / STOMACH$_{(g)}$
A	14	0	0.45
B	106	18	0.39

Fig. 38. Diet of Arctic flounder captured between late June and mid-September 1978-1980, as revealed by analysis of stomachs from two coastal areas of the southeastern Beaufort Sea.

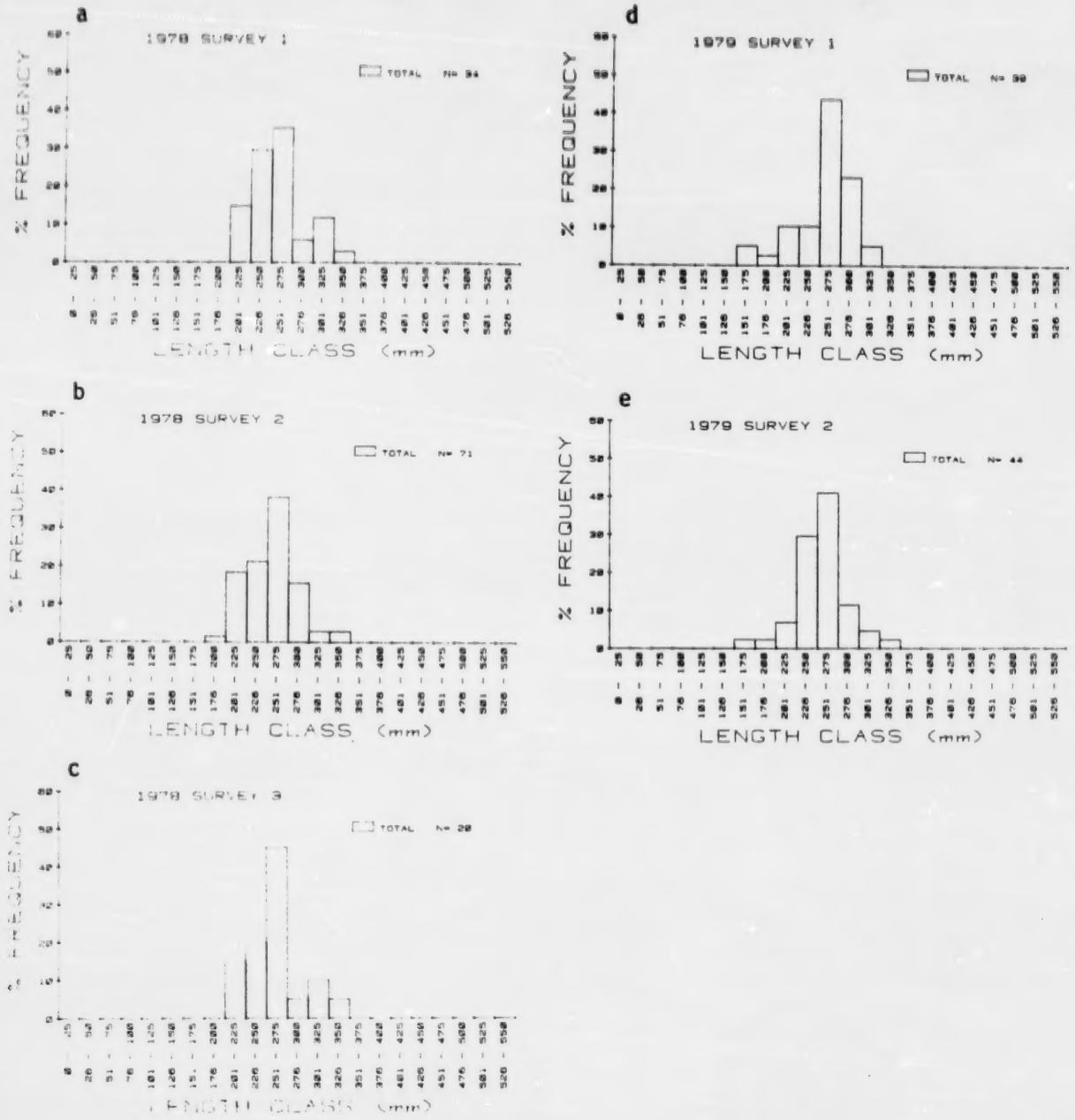
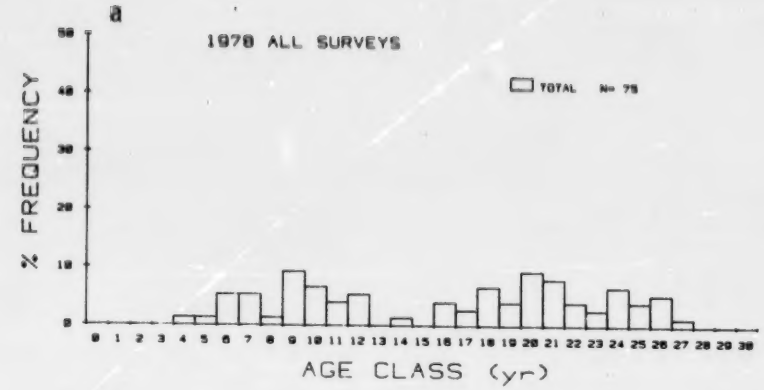


Fig. 39. Length-frequency distribution of gillnetted starry flounder from coastal embayments of Tuktoyaktuk Peninsula: a), b), c) 1978 surveys 1 (June/July), 2 (August) and 3 (September) respectively; d), e) 1979 surveys 1 (June/July) and 2 (August) respectively.



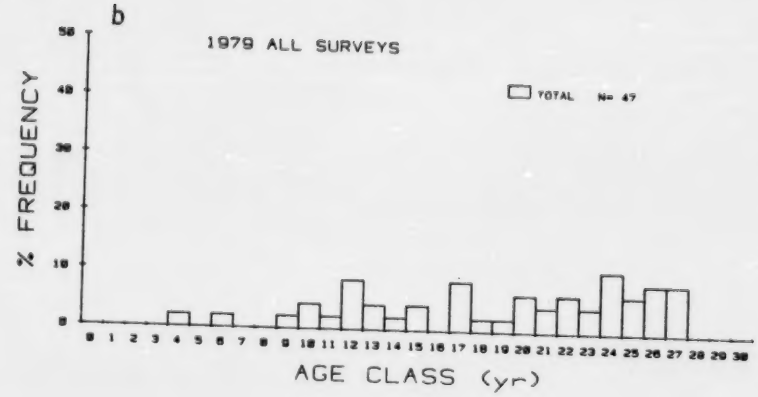


Fig. 40. Age-frequency distribution of gillnetted starry flounder from coastal embayments of Tuktoyaktuk Peninsula: a) 1978 combined surveys data; b) 1979 combined surveys data.

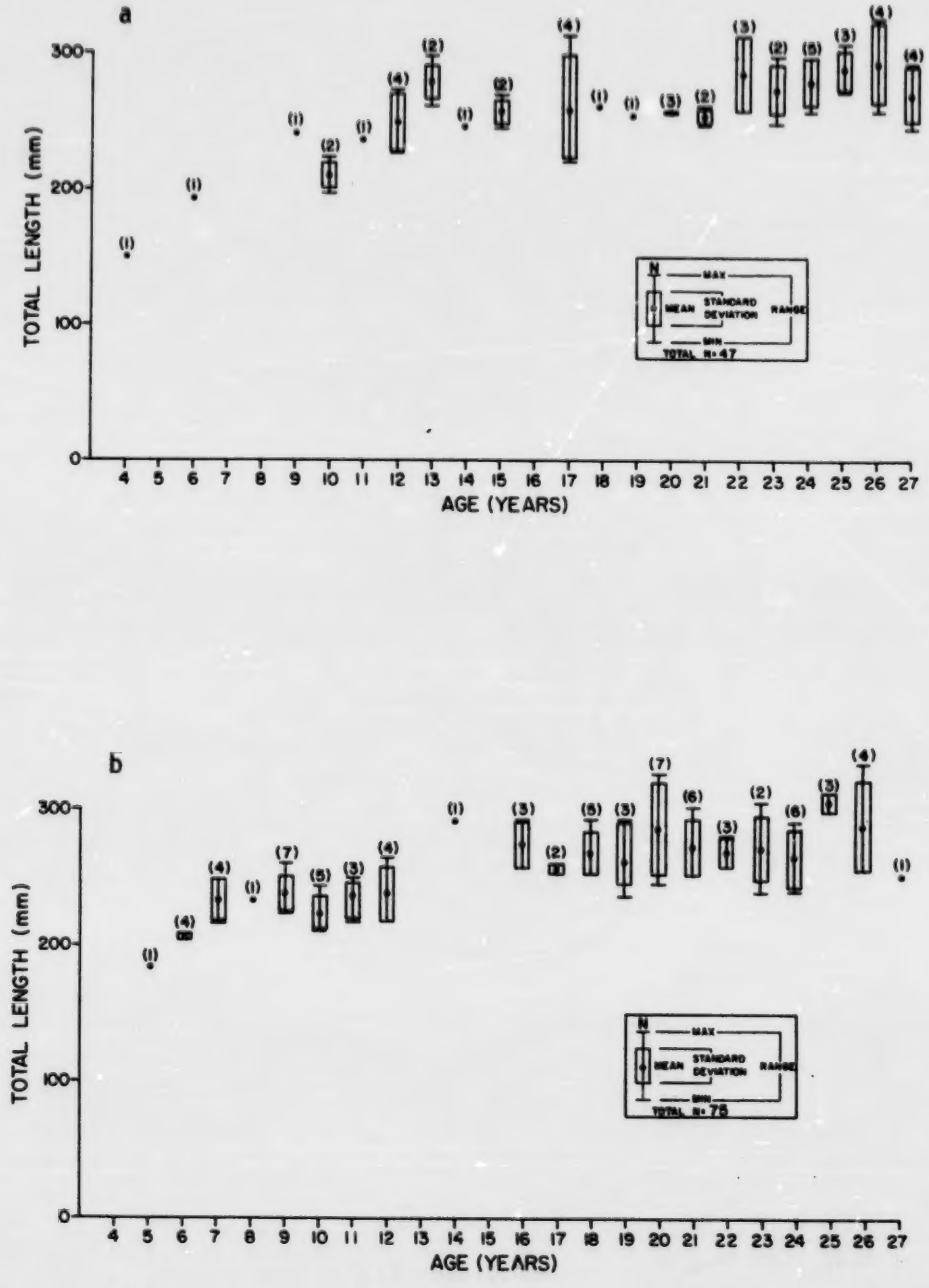
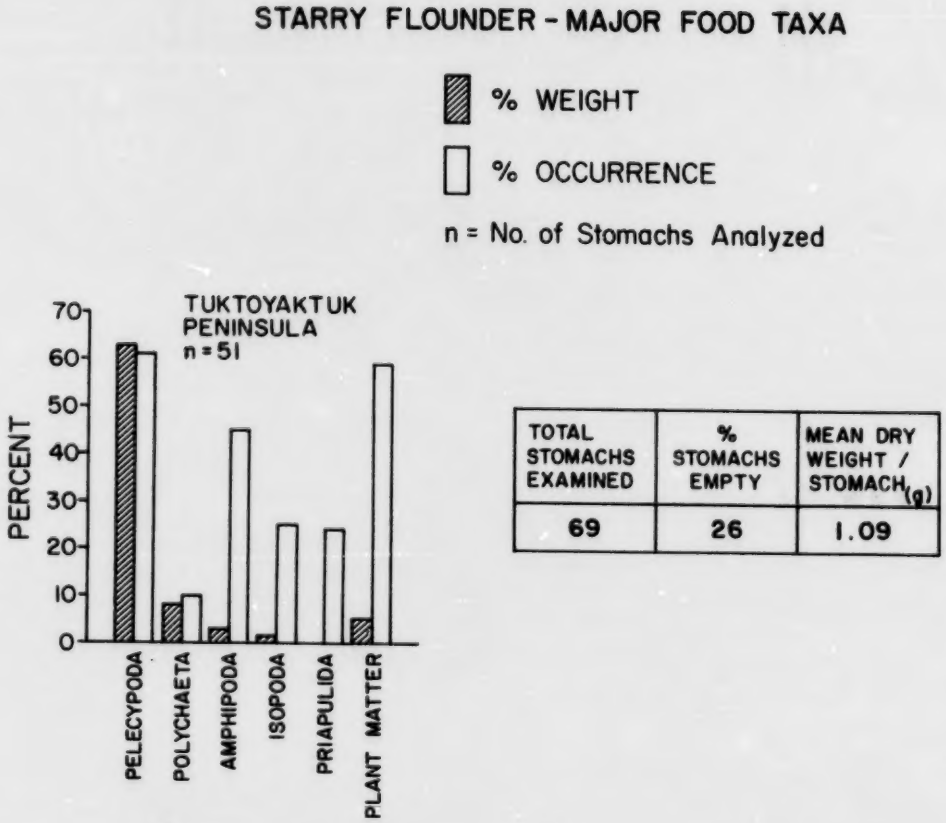


Fig. 41. Starry flounder age-length relationships: a) 1978 combined surveys data; b) 1979 combined surveys data.



TOTAL STOMACHS EXAMINED	% STOMACHS EMPTY	MEAN DRY WEIGHT / STOMACH (g)
69	26	1.09

Fig. 42. Diet of starry flounder captured between late June and mid-September 1978-1979, as revealed by analysis of stomachs from the coast of Tuktoyaktuk Peninsula.

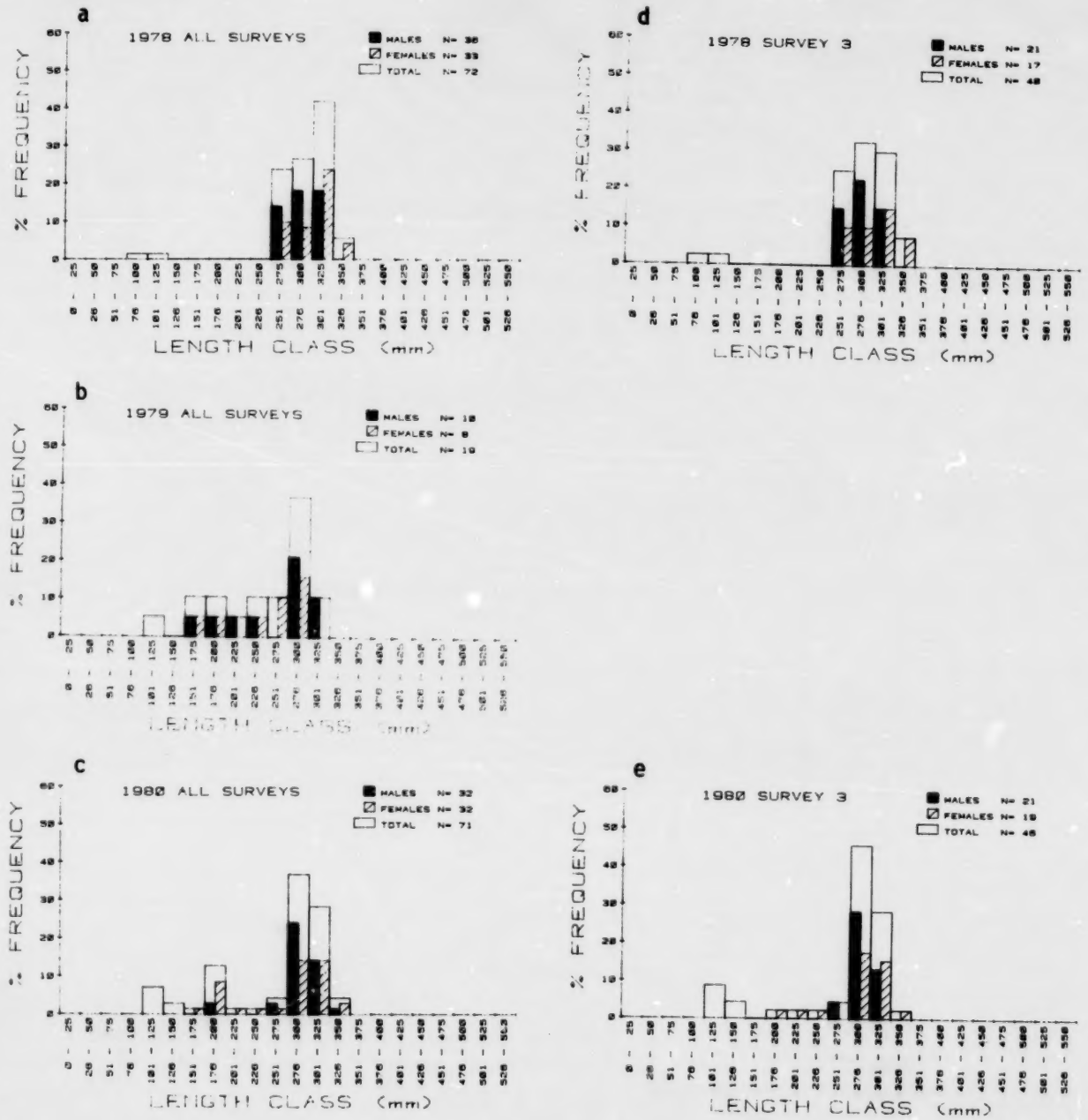


Fig. 43. Length-frequency distribution of gillnetted Pacific herring from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) - combined surveys data 1978, 1979 and 1980 respectively; d), e) survey 3 (September) data, 1978 and 1980 respectively.

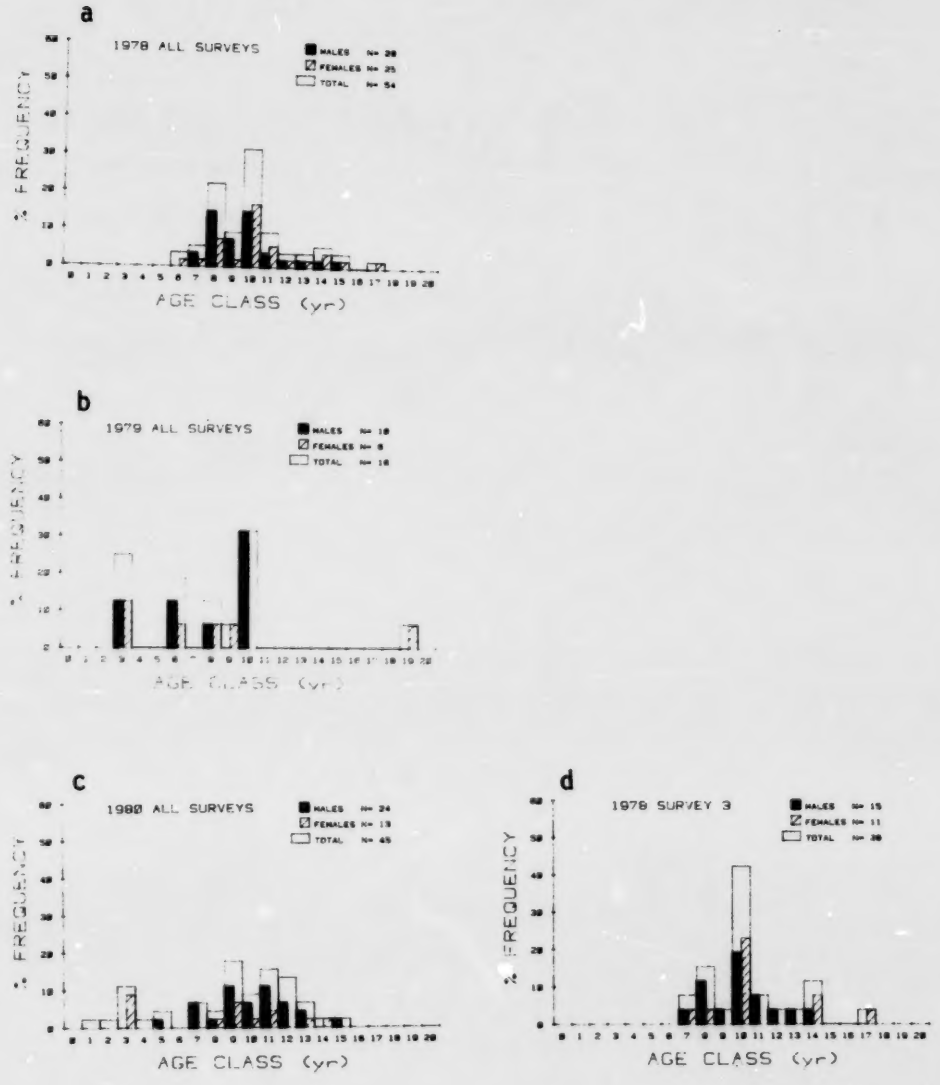


Fig. 44. Age-frequency distribution of gillnetted Pacific herring from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) combined surveys data 1978, 1979 and 1980 respectively; d) survey 3 (September) data, 1978.

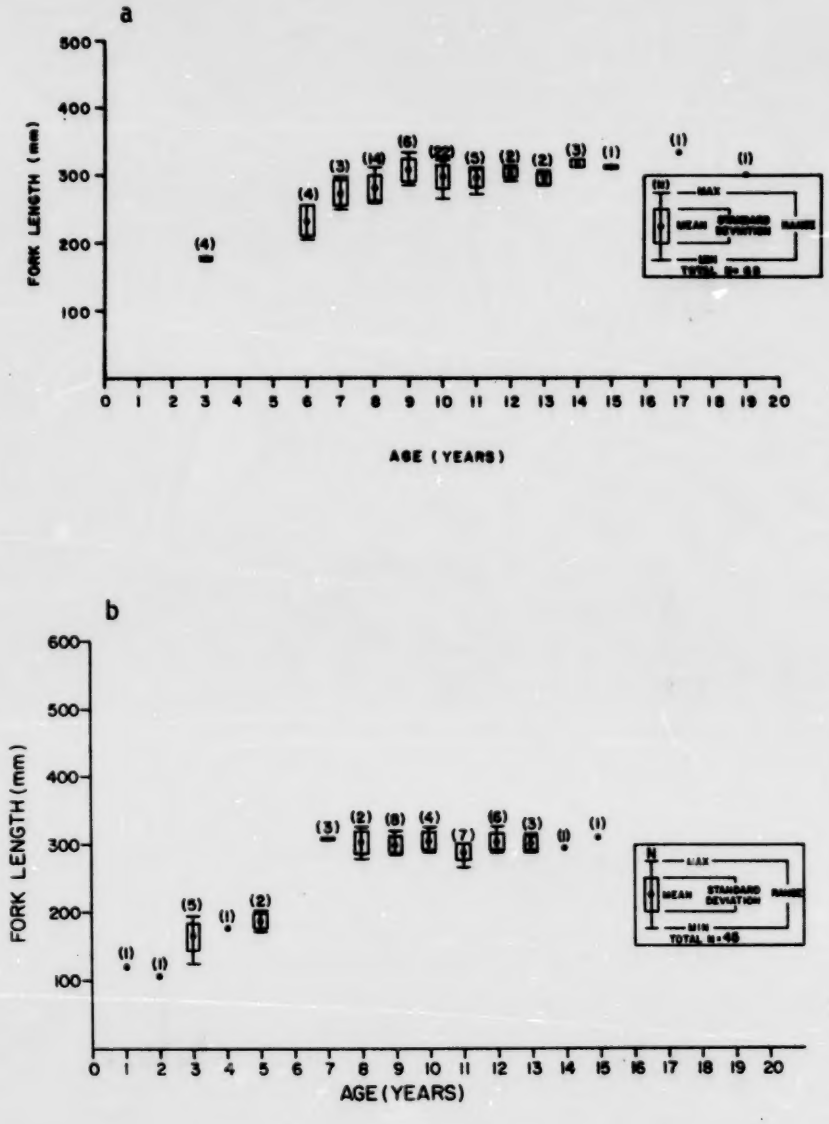


Fig. 45. Pacific herring age-length relationships: a) 1978 and 1979 combined surveys data; b) 1980 combined surveys data.

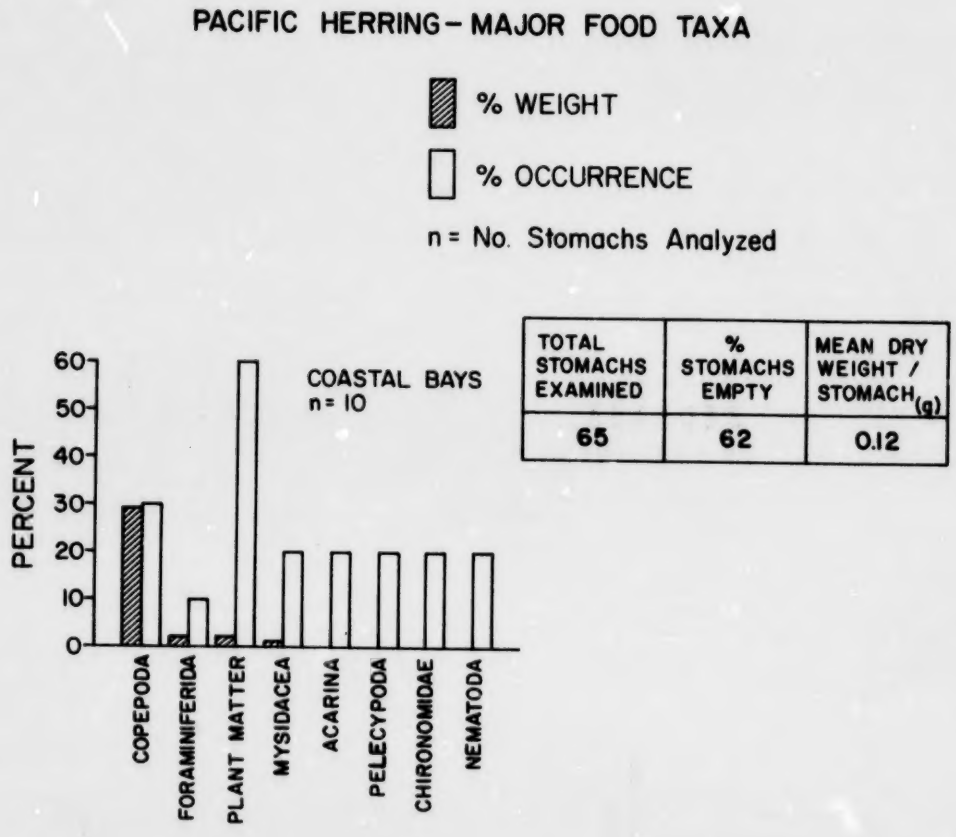
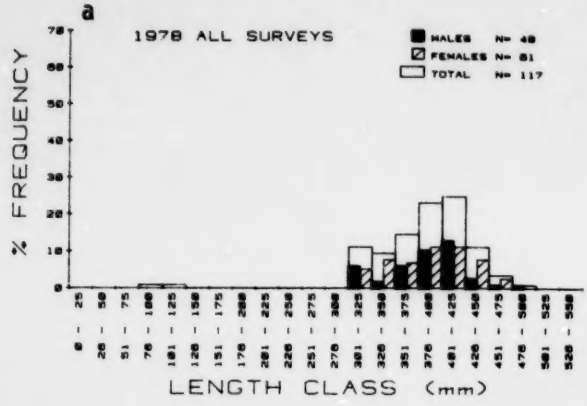
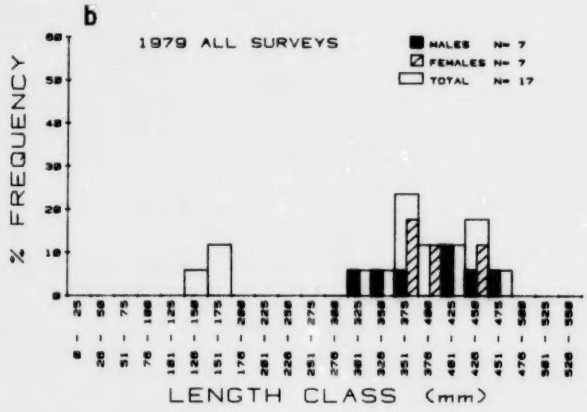


Fig. 46. Diet of Pacific herring captured between late June and mid-September 1978-1980, as revealed by analysis of stomachs from coastal areas of the southeastern Beaufort Sea.





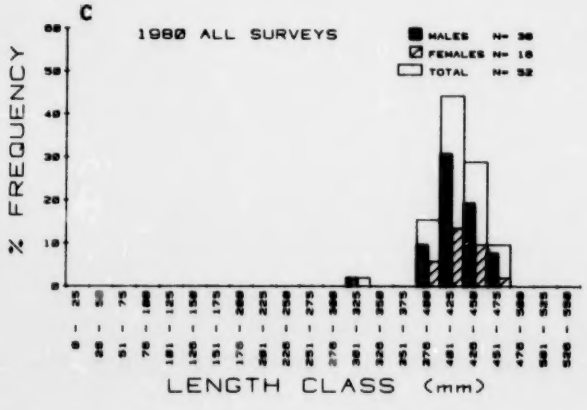
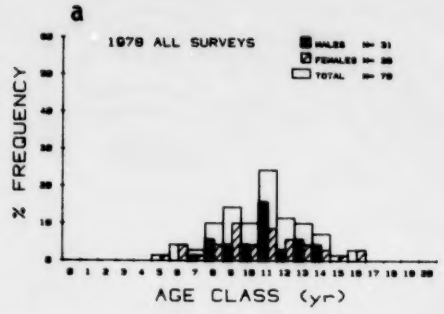


Fig. 47. Length-frequency distribution of gillnetted saffron cod from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) combined surveys data 1978, 1979 and 1980 respectively.



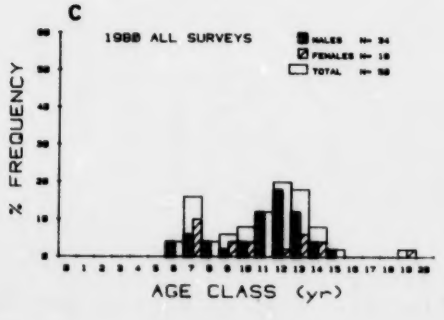


Fig. 48. Age-frequency distribution of gillnetted saffron cod from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) combined surveys data 1978, 1979 and 1980 respectively.

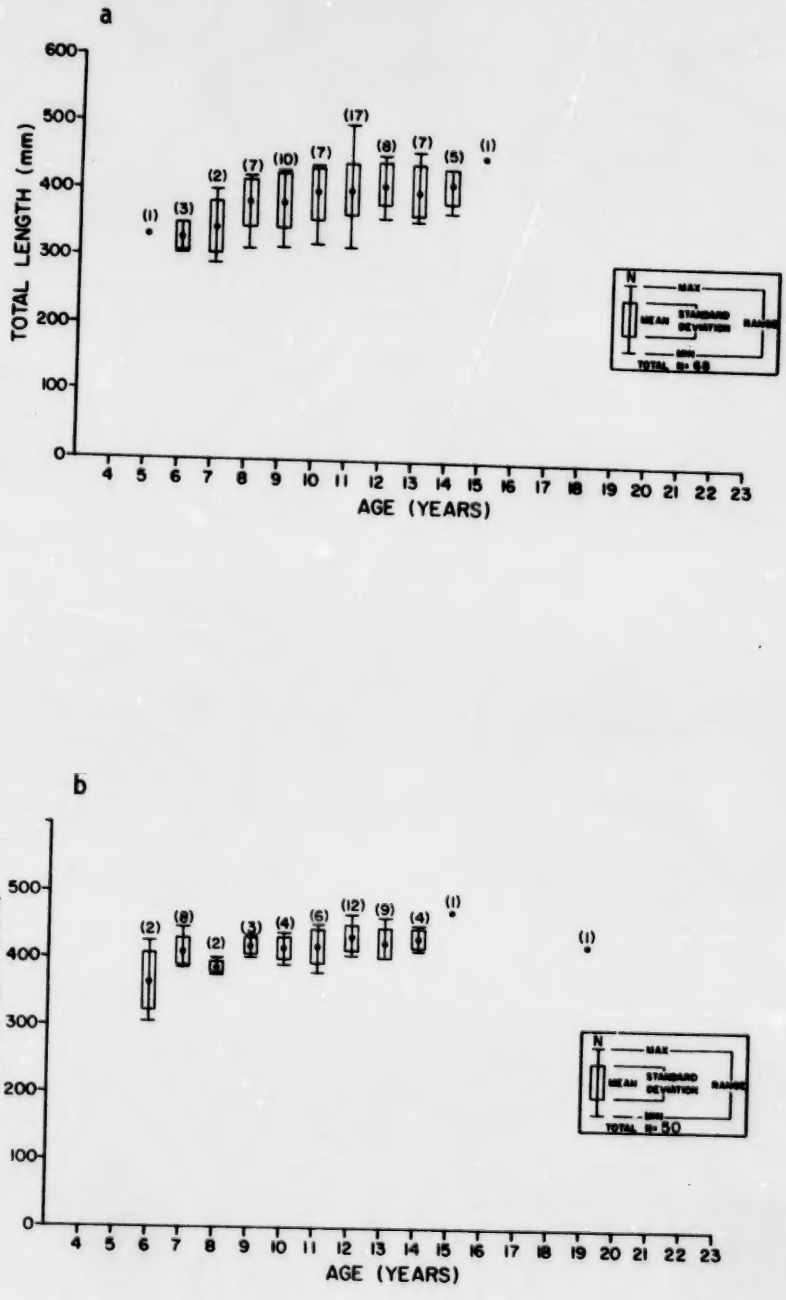
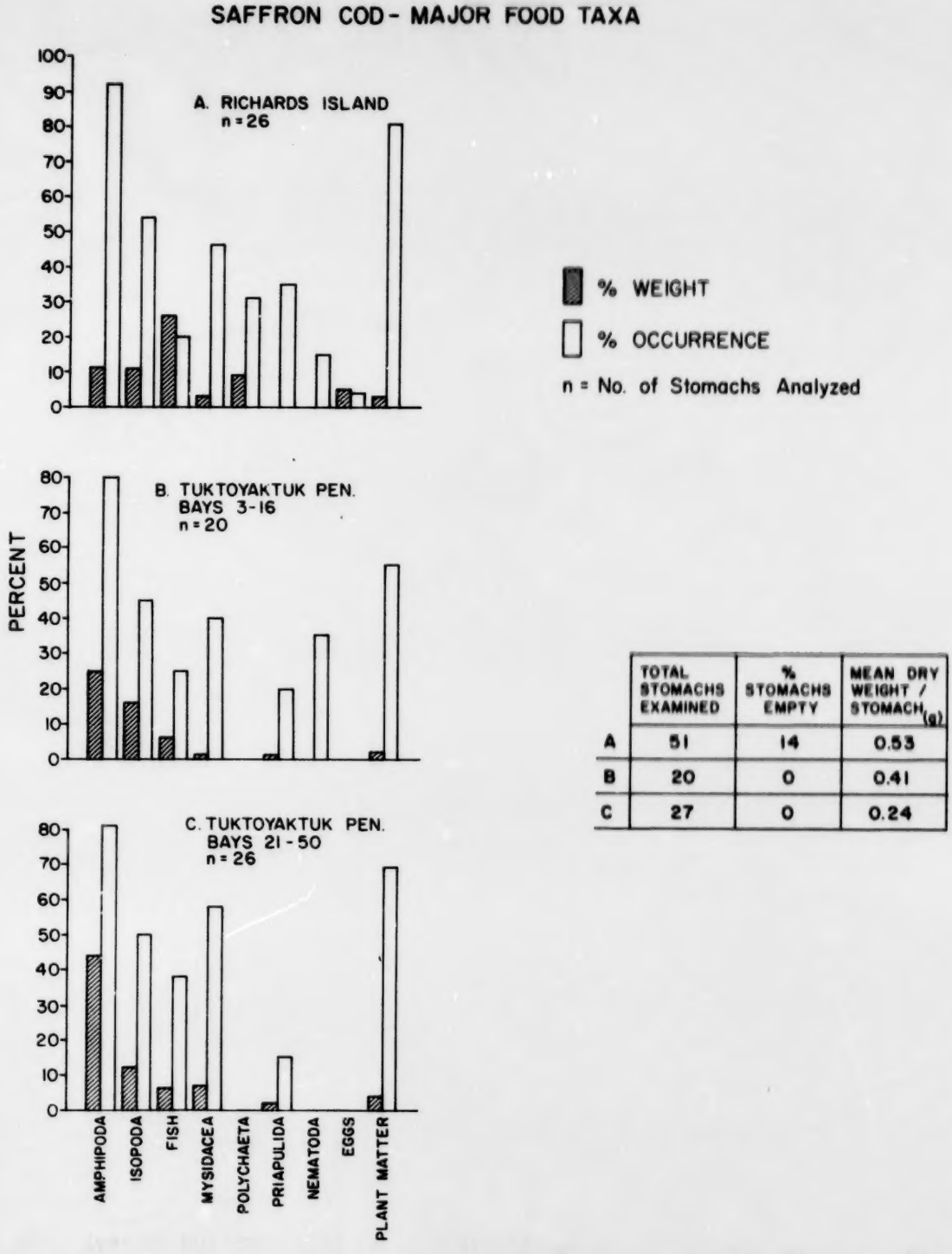


Fig. 49. Saffron cod age-length relationships: a) 1978 combined surveys data, b) 1980 combined surveys data.



	TOTAL STOMACHS EXAMINED	% STOMACHS EMPTY	MEAN DRY WEIGHT / STOMACH (g)
A	51	14	0.53
B	20	0	0.41
C	27	0	0.24

Fig. 50. Diet of saffron cod captured between late June and mid-September 1978-1980, as revealed by analysis of stomachs from three coastal areas of the southeastern Beaufort Sea.

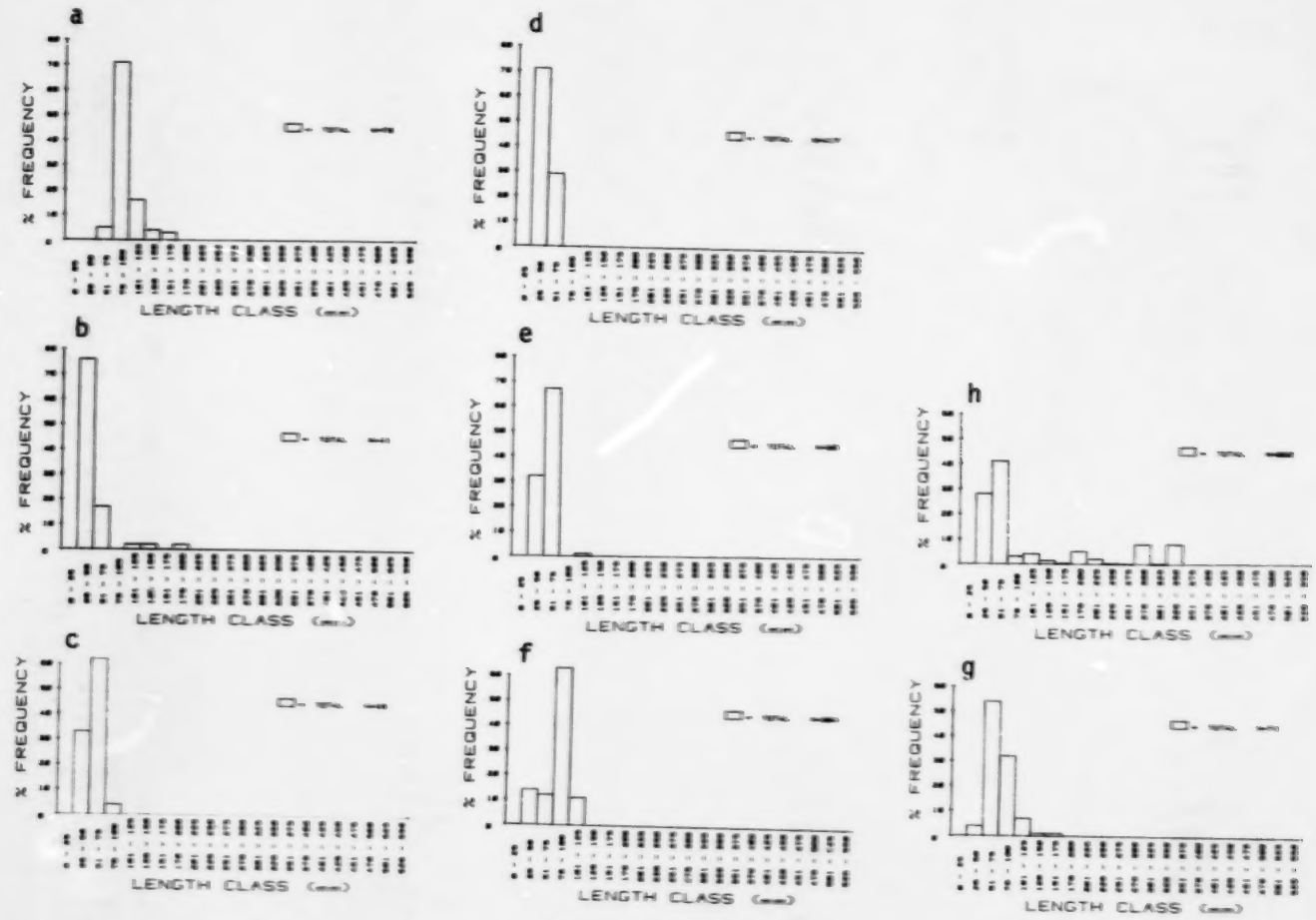


Fig. 51. Length-frequency distribution of seine-caught Arctic cisco from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) 1978 surveys 1 (June/July), 2 (August) and 3 (September respectively; d), e), f) 1979 surveys 1 (June/July), 2 (August) and 3 (September) respectively; g), h) 1980 surveys 2 (August), 3 (September) respectively.

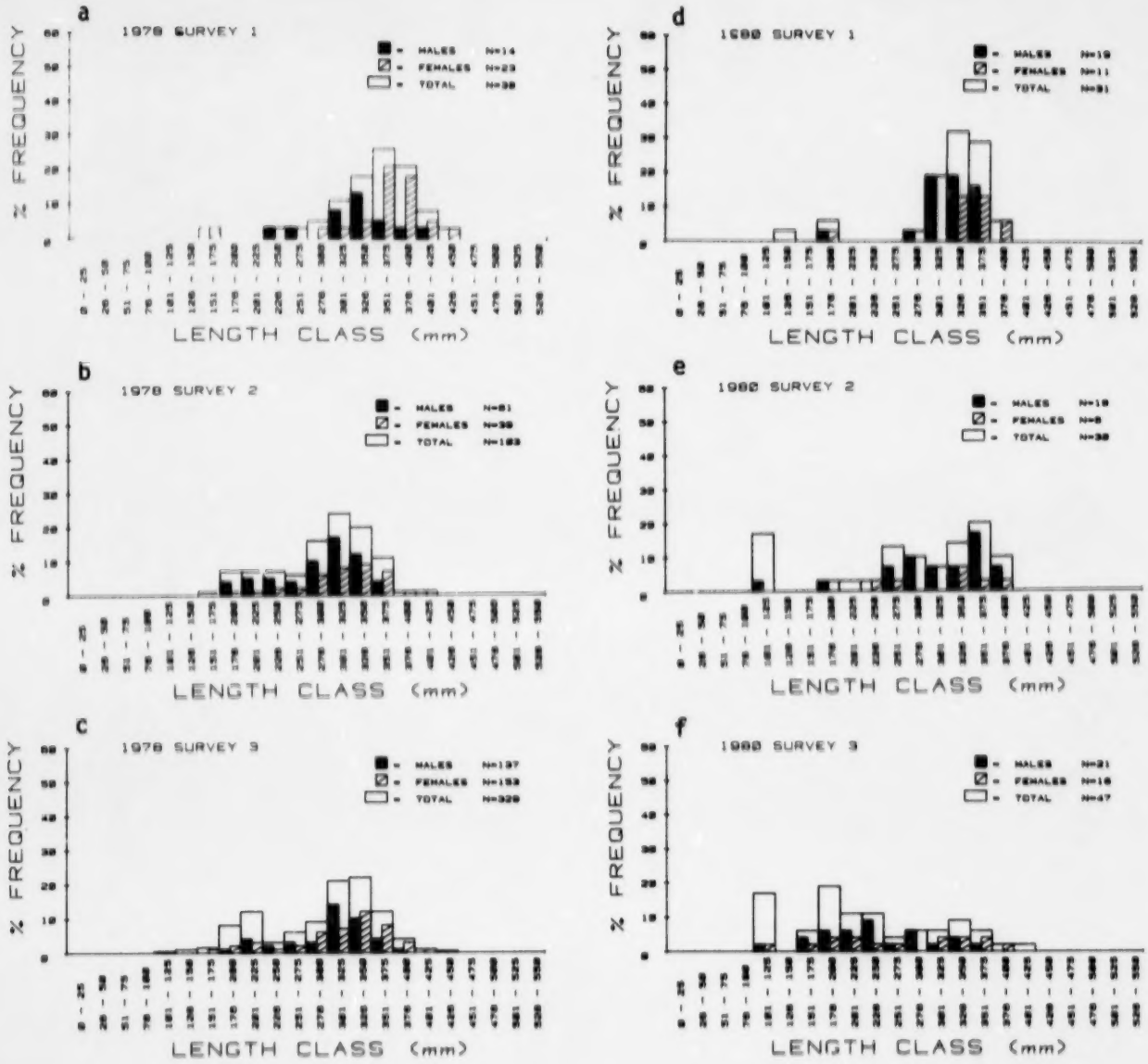


Fig. 52. Length-frequency distribution of gillnetted Arctic cisco from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) 1978 surveys 1 (June/July), 2 (August) and 3 (September) respectively; d), e), f) 1980 surveys 1 (June/July), 2 (August) and 3 (September) respectively.

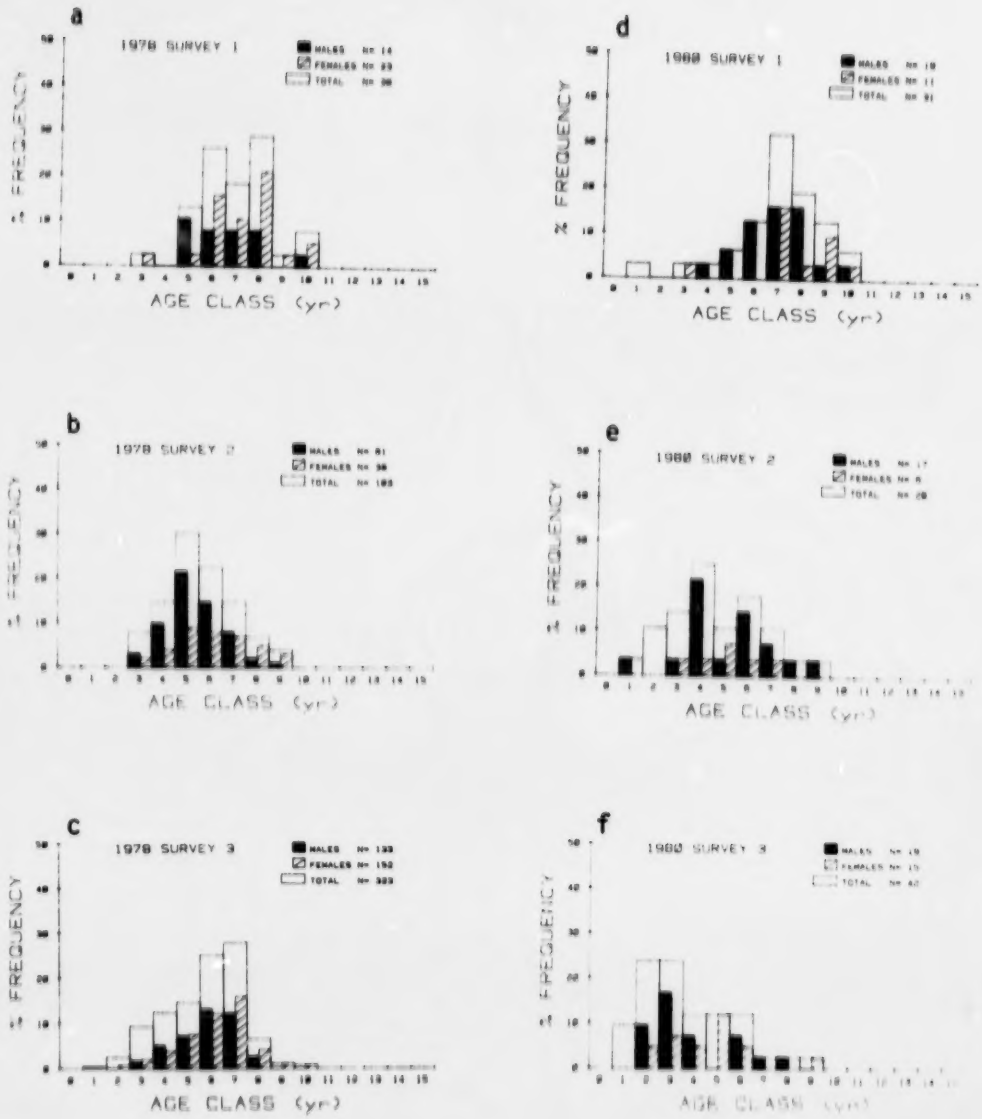


Fig. 53. Age-frequency distribution of gillnetted Arctic cisco from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) 1978 surveys 1 (June/July), 2 (August) and 3 (September) respectively; d), e), f) 1980 surveys 1 (June/July), 2 (August) and 3 (September) respectively.

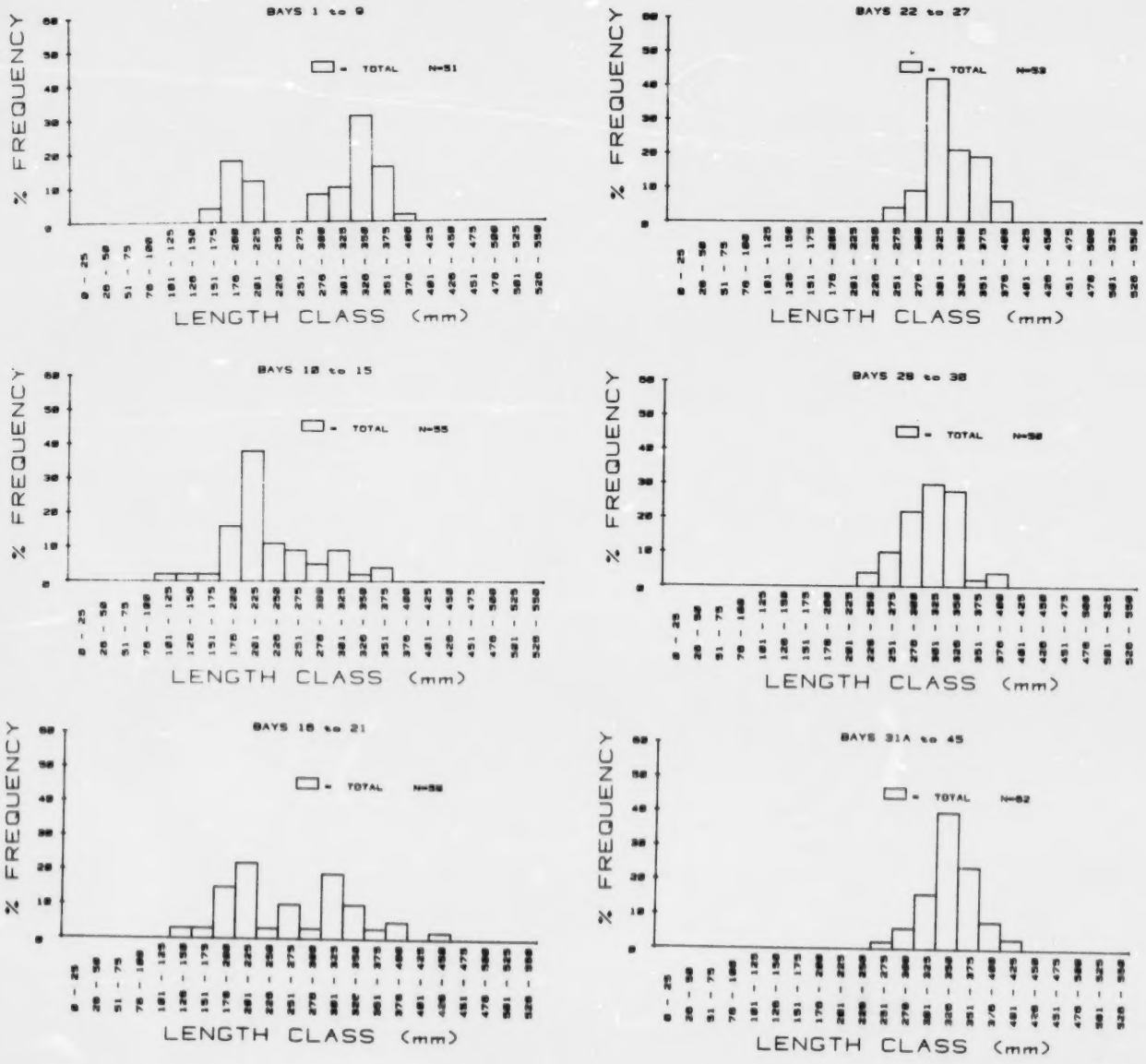
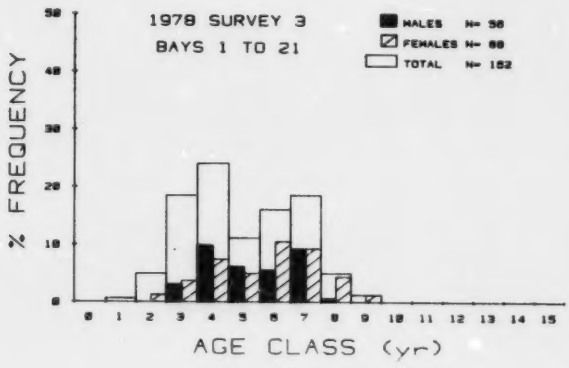


Fig. 54. Length-frequency distribution of gillnettted Arctic cisco from six coastal sample groups according to increasing distance from the East Channel of the Mackenzie River: survey 3 (September) data 1978. (Refer to Fig. 1 for locations.)



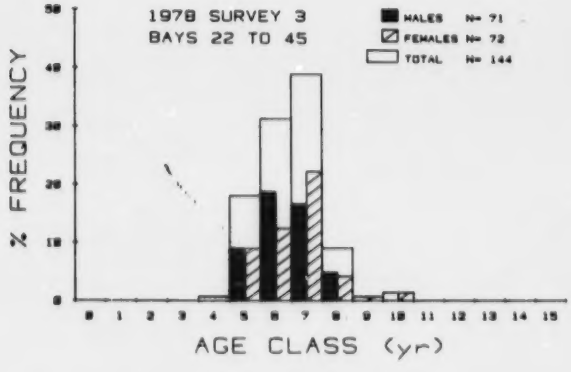


Fig. 55. Age-frequency distribution of Arctic cisco for two sample groups caught along the Tuktoyaktuk Peninsula during survey 3 (September) 1978. (Refer to Fig. 1 for locations.)

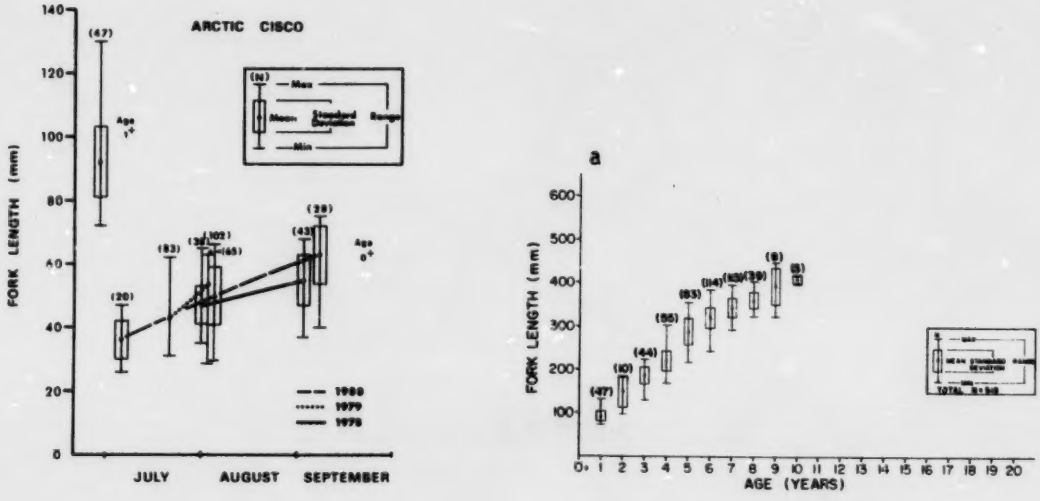


Fig. 56. Growth rate for Arctic cisco young-of-the-year - 1978, 1979 and 1980.

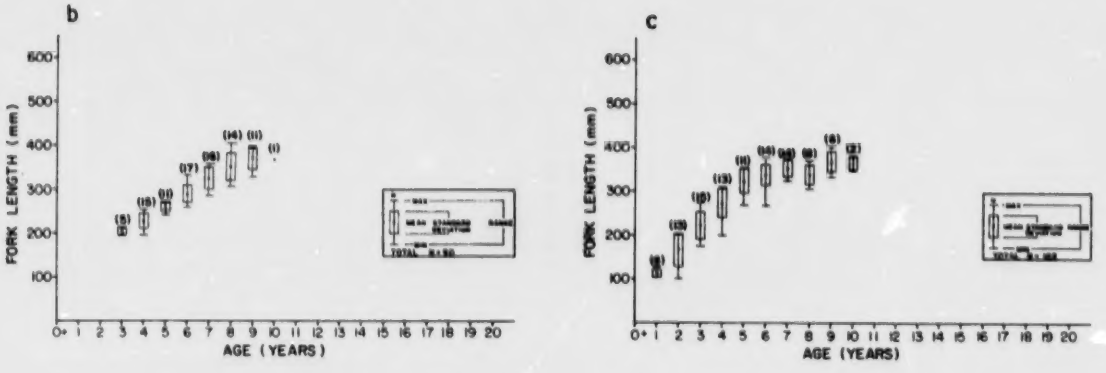


Fig. 57. Arctic cisco age-length relationships: a) 1978 combined surveys data; b) 1979 combined surveys data; c) 1980 combined surveys data.

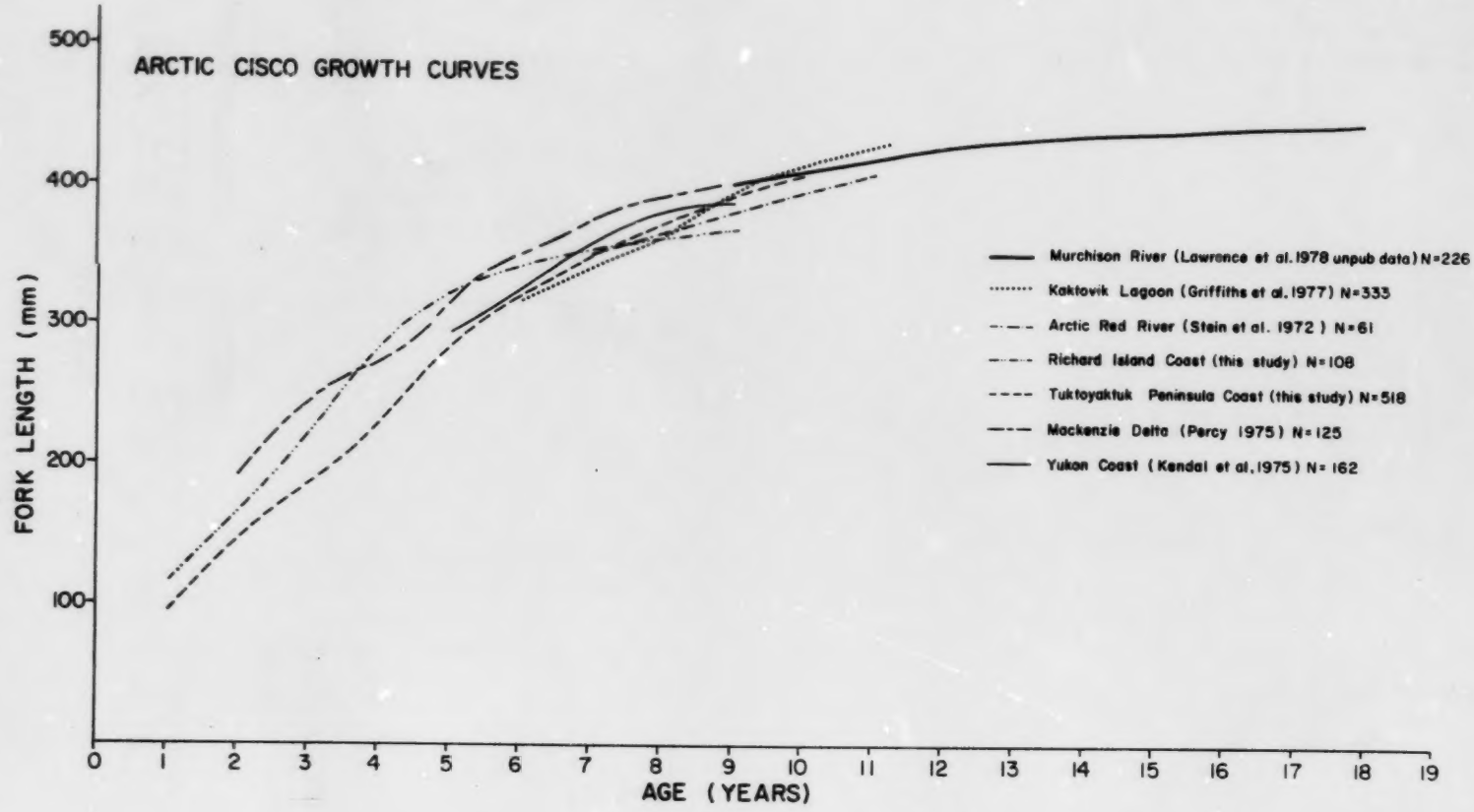
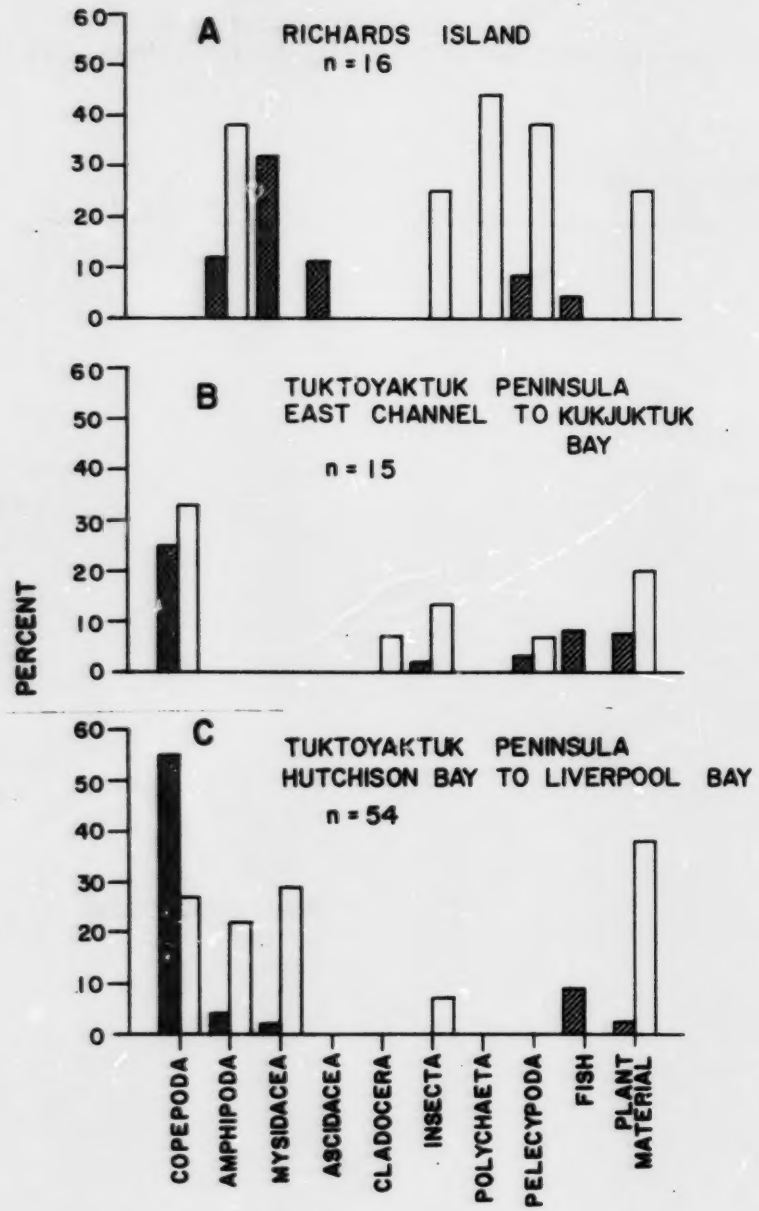


Fig. 58. Growth curves of Arctic cisco from various studies and locations along the Beaufort Coast and from the Murchison River, NWT.

ARCTIC CISCO — MAJOR FOOD TAXA



LEGEND

% WEIGHT

% OCCURRENCE

n = NUMBER OF STOMACHS

	TOTAL STOMACHS EXAMINED	% STOMACHS EMPTY	MEAN DRY WEIGHT / STOMACH (g)
A	71	68	0·33
B	60	33	0·04
C	81	33	0·13

Fig. 59. Diet of arctic cisco captured between late June and mid-September 1978-80, as revealed by analysis of stomachs from three coastal areas of the south-eastern Beaufort Sea.

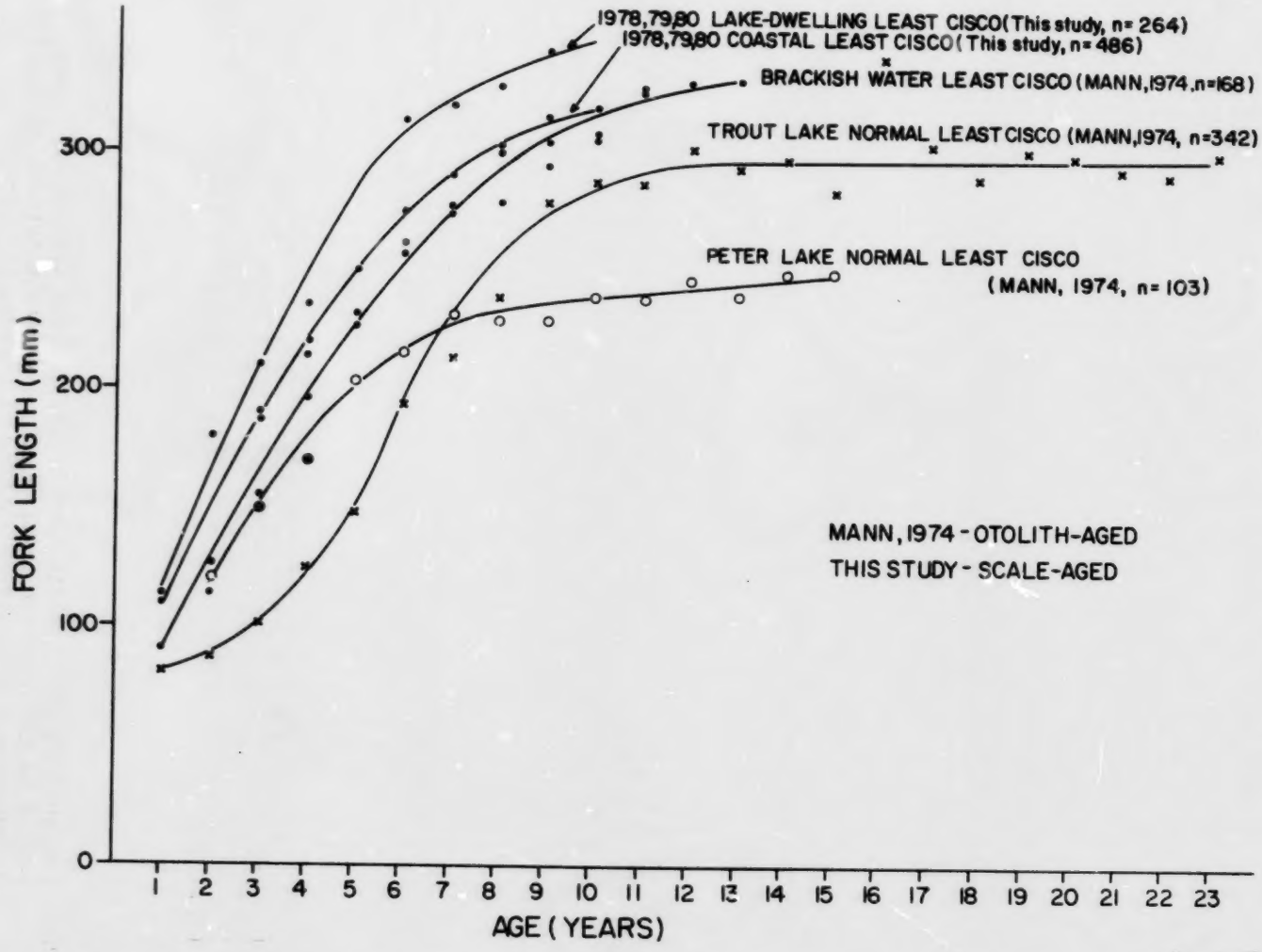

1978,79,80 LAKE-DWELLING LEAST CISCO(This study, n= 264)
1978,79,80 COASTAL LEAST CISCO(This study, n= 486)
BRACKISH WATER LEAST CISCO (MANN,1974,n=168)
TROUT LAKE NORMAL LEAST CISCO (MANN,1974, n=342)
PETER LAKE NORMAL LEAST CISCO
(MANN, 1974, n= 103)
MANN, 1974 - OTOLITH-AGED
THIS STUDY - SCALE-AGED
FORK LENGTH (mm)
0
100
200
300
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
AGE (YEARS)

Fig. 60. Comparison of growth rate data from Mann (1974) and this study for least cisco populations from fresh and brackish water.

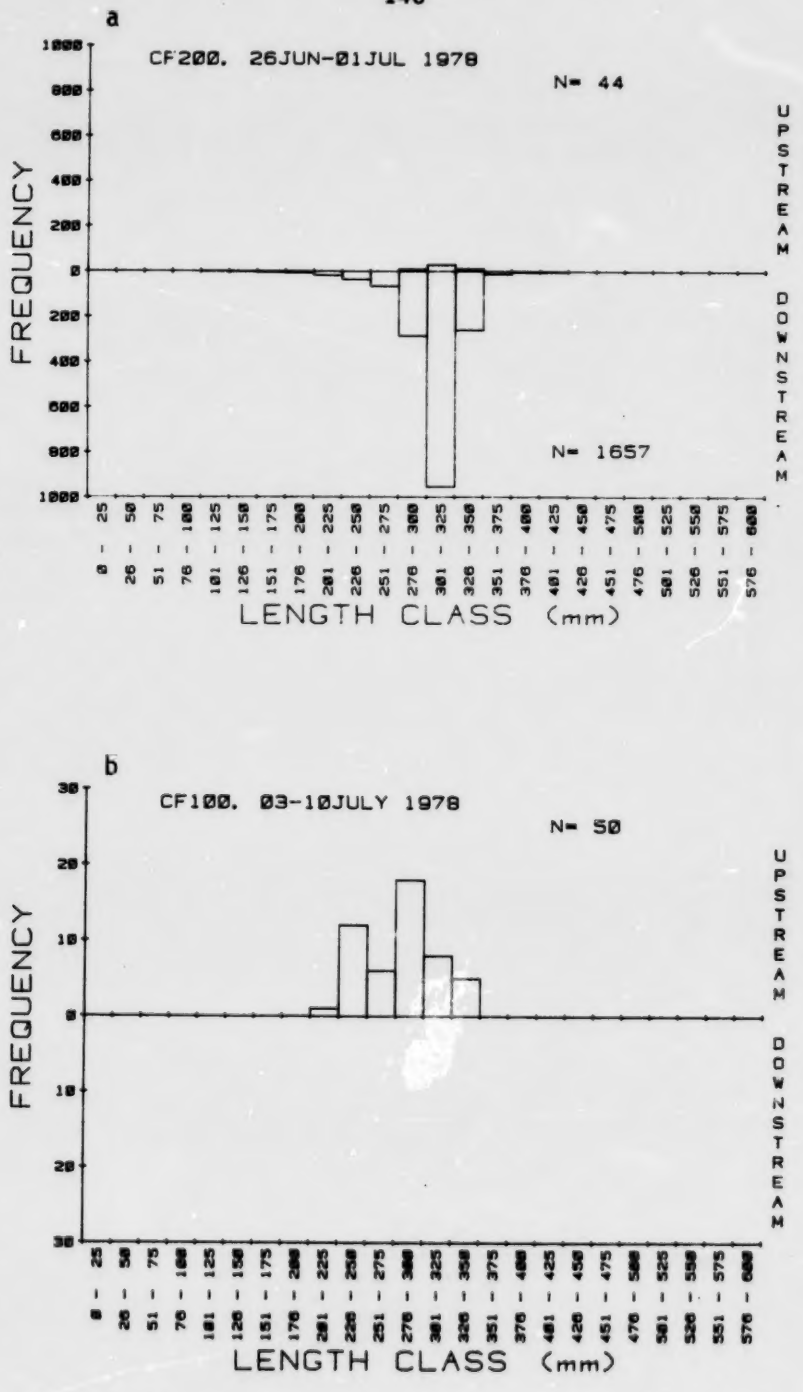


Fig. 61. Length-frequency distribution of least cisco sampled at fences placed on the Canyanek Creek (Loc. 1) drainage system, spring 1978: a) downstream migrants at outflow of Lake 2; b) upstream migrants from coast to Lake 1. (Refer to Fig. 1 for locations.)

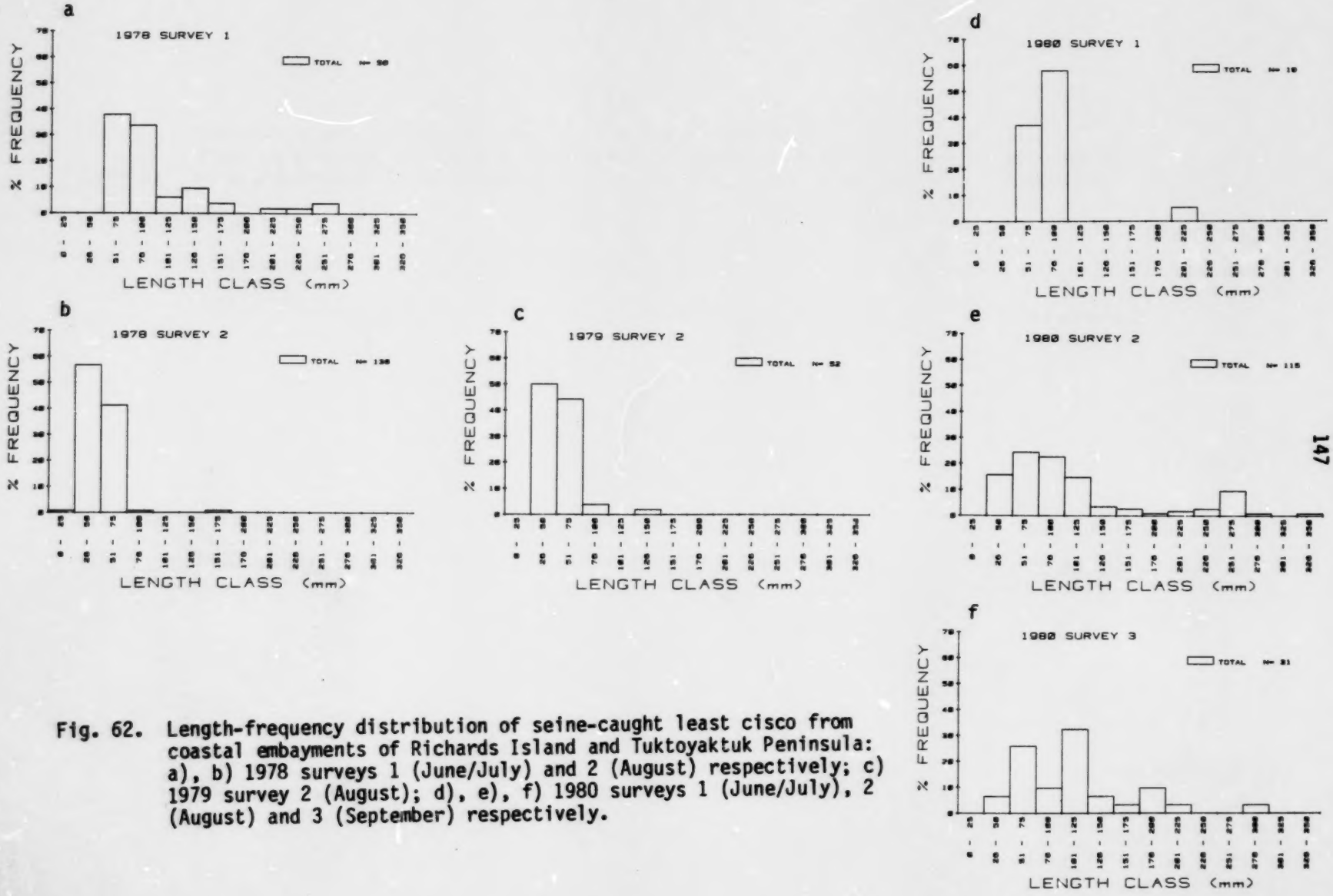


Fig. 62. Length-frequency distribution of seine-caught least cisco from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b) 1978 surveys 1 (June/July) and 2 (August) respectively; c) 1979 survey 2 (August); d), e), f) 1980 surveys 1 (June/July), 2 (August) and 3 (September) respectively.

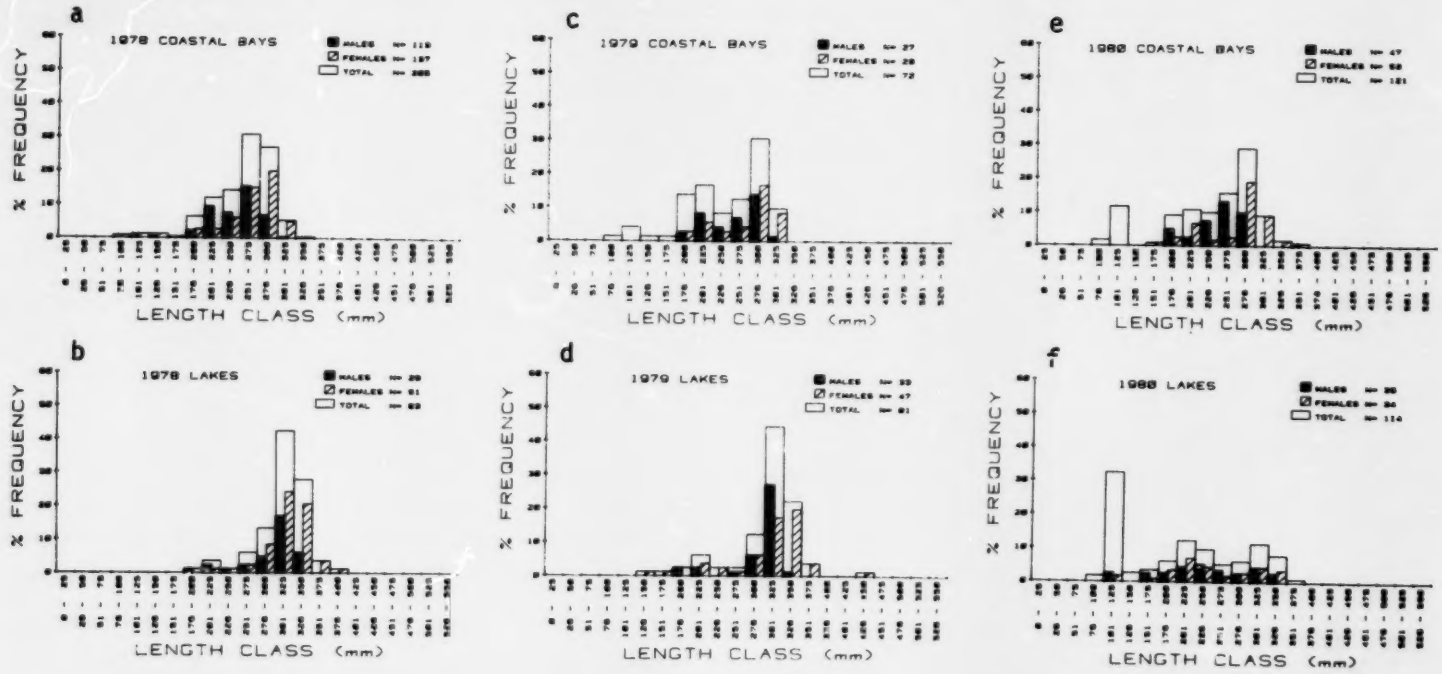


Fig. 63. Length-frequency distribution of gillnetted least cisco from coastal embayments and freshwater lakes of Richards Island and Tuktoyaktuk Peninsula: a), b) combined surveys data 1978; c), d) combined surveys data 1979; e), f) combined surveys data 1980.

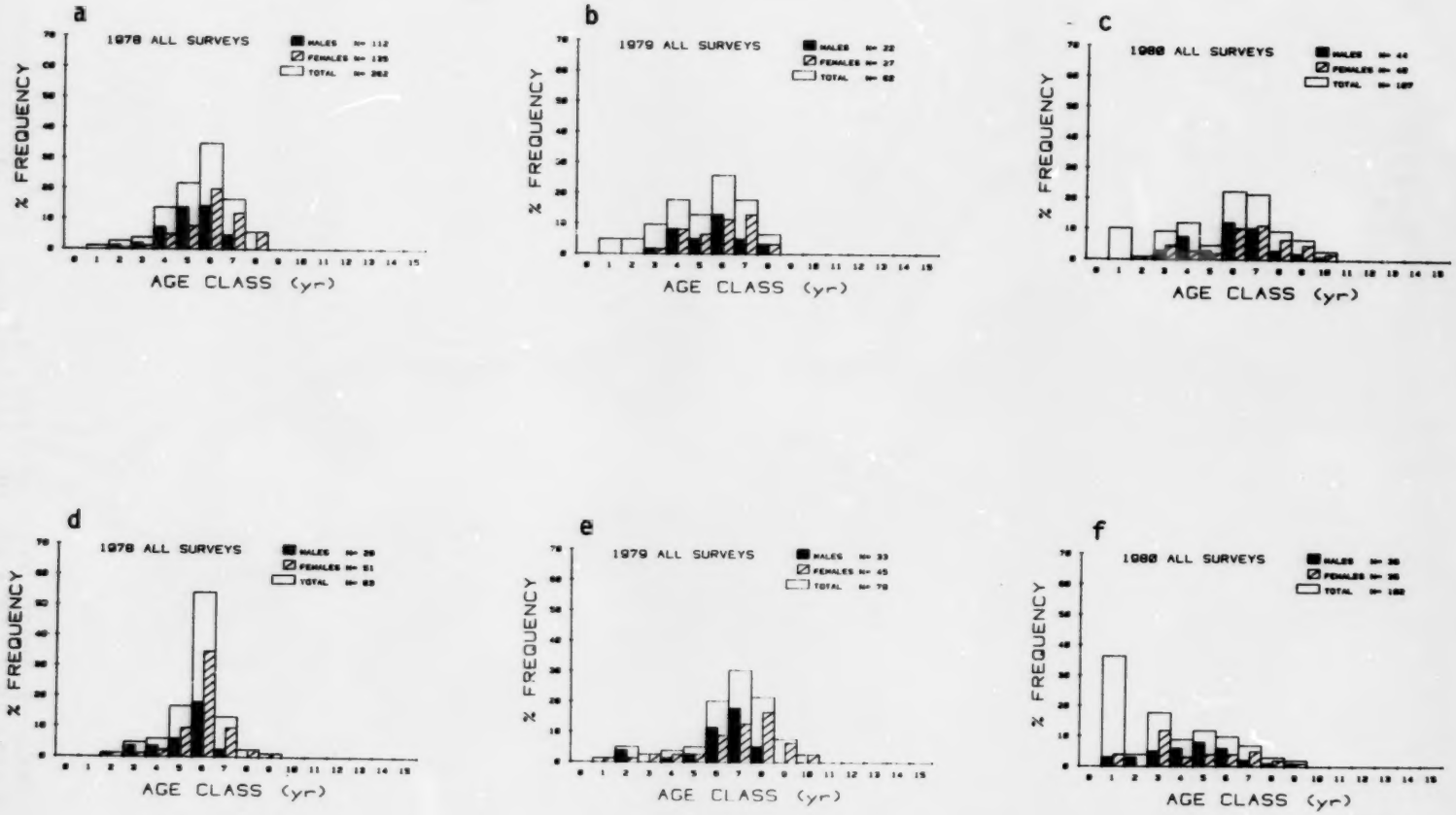


Fig. 64. Age-frequency distribution of gillnetted least cisco from coastal embayments and freshwater lakes of Richards Island and Tuktoyaktuk Peninsula: a), b), c) combined coastal surveys data 1978, 1979 and 1980 respectively; d), e), f) combined lake surveys data 1978, 1979 and 1980 respectively.

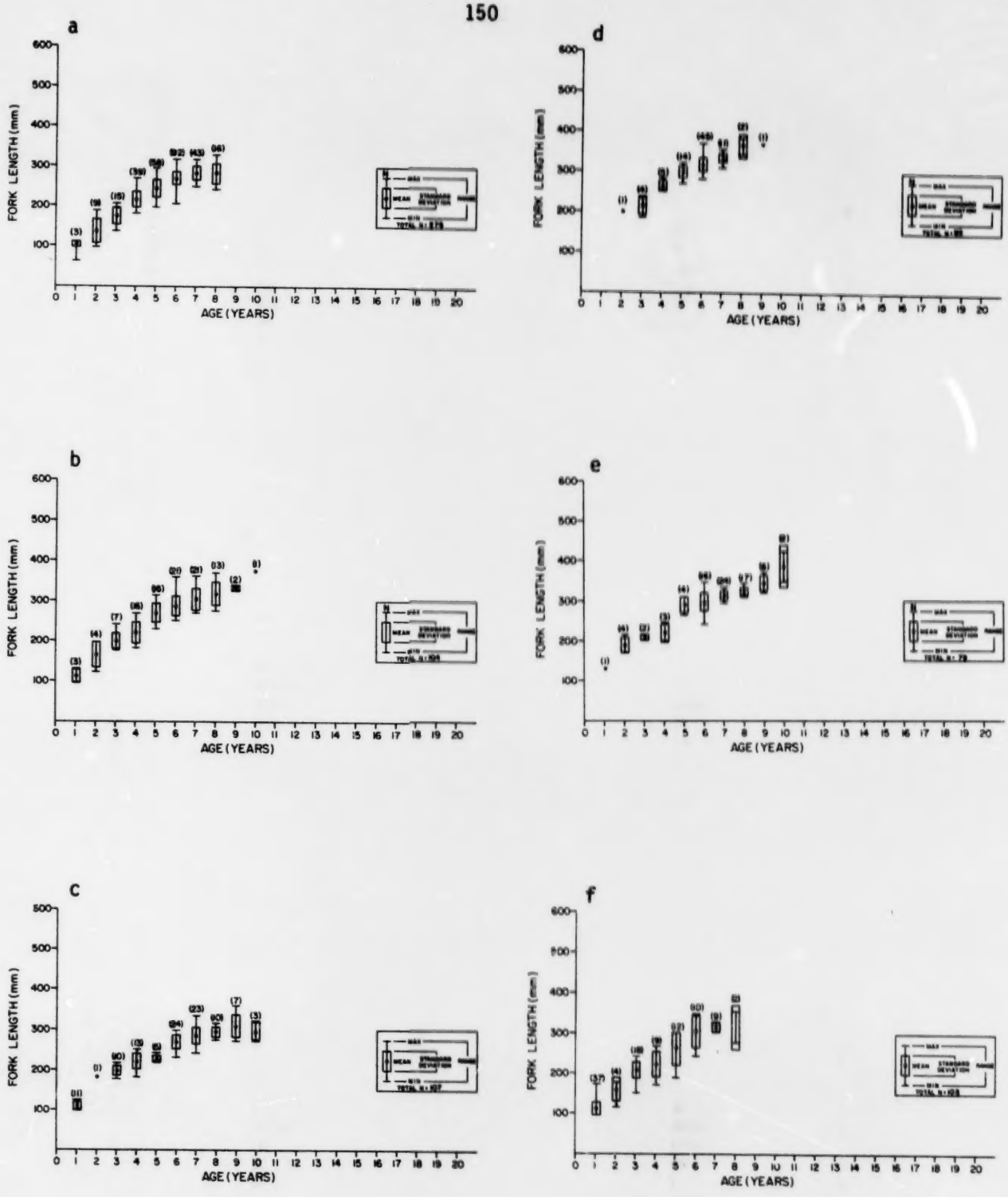
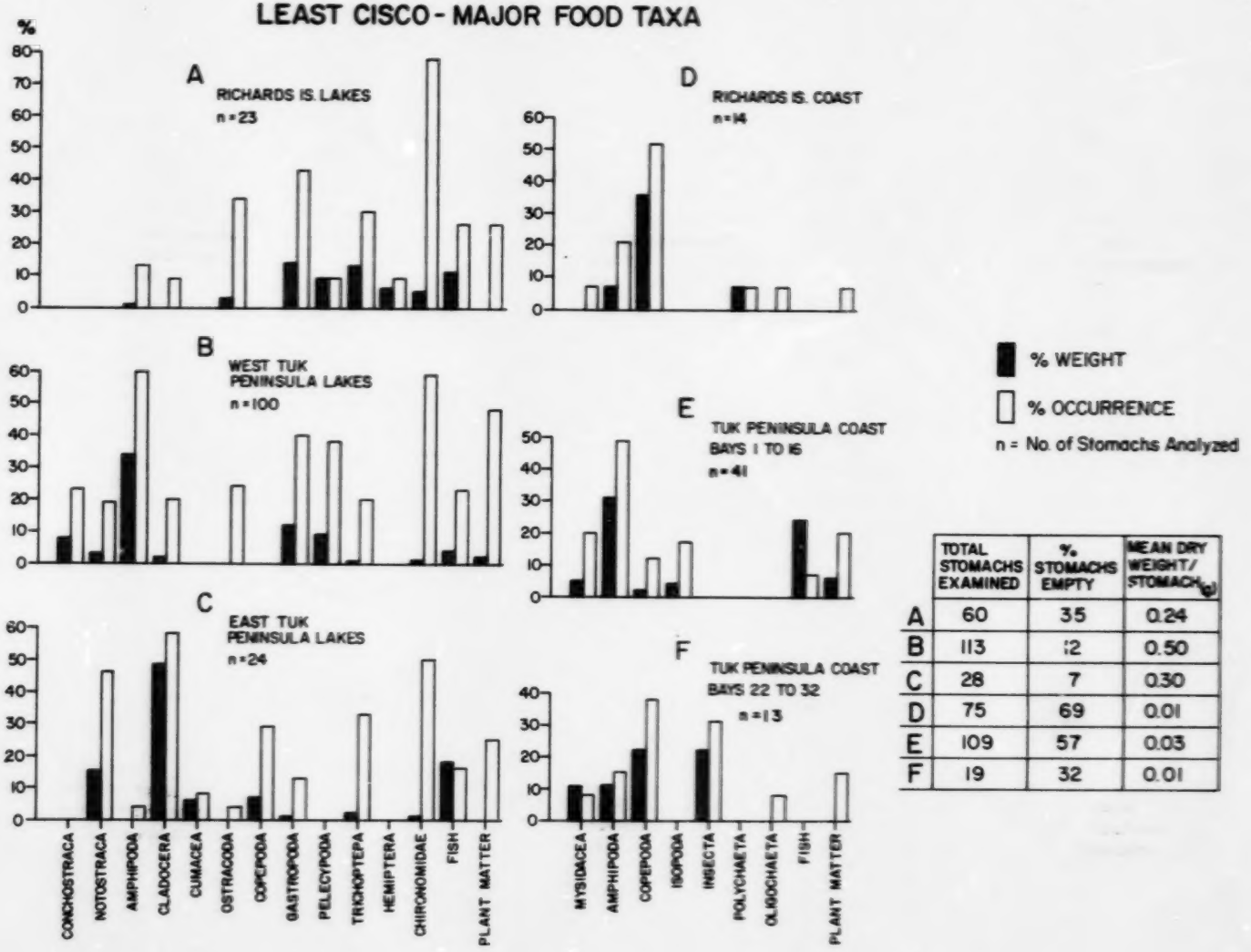


Fig. 65. Least cisco age-length relationships: a), b), c) combined coastal surveys data 1978, 1979 and 1980 respectively; d), e), f) combined lake surveys data 1978, 1979 and 1980 respectively.



	TOTAL STOMACHS EXAMINED	% STOMACHS EMPTY	MEAN DRY WEIGHT/ STOMACH (g)
A	60	35	0.24
B	113	12	0.50
C	28	7	0.30
D	75	69	0.01
E	109	57	0.03
F	19	32	0.01

Fig. 66. Diet of least cisco captured between late June and mid-September 1978-1980, as revealed by analysis of stomachs from freshwater lakes on Richards Island and Tuktoyaktuk Peninsula and coastal areas of the southeastern Beaufort Sea.

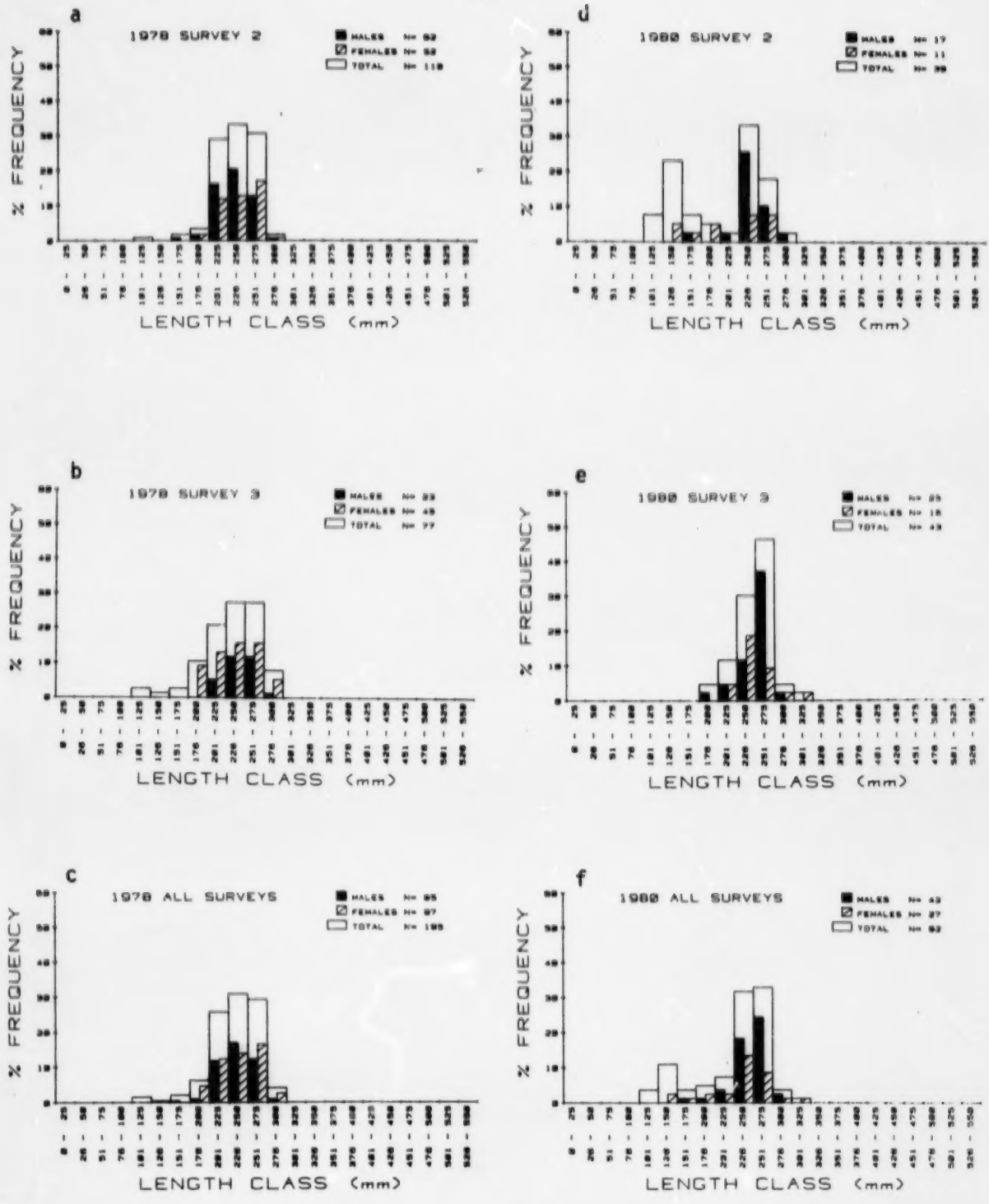


Fig. 67. Length-frequency distribution of gillnetted rainbow smelt from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) 1978 surveys 2 (August), 3 (September) and combined surveys data respectively; d), e), f) 1980 surveys 2 (August), 3 (September) and combined surveys data, respectively.

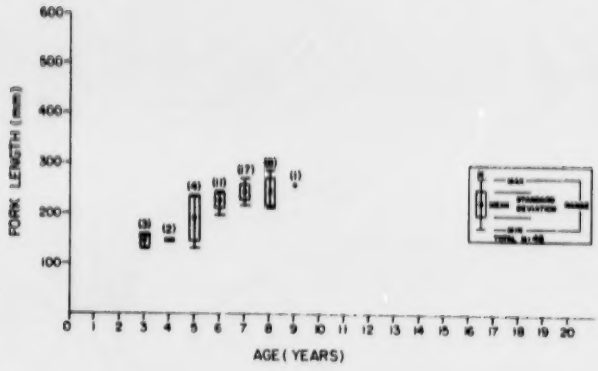


Fig. 68. Rainbow smelt age-length relationship: combined surveys data for 1978, 1979 and 1980.

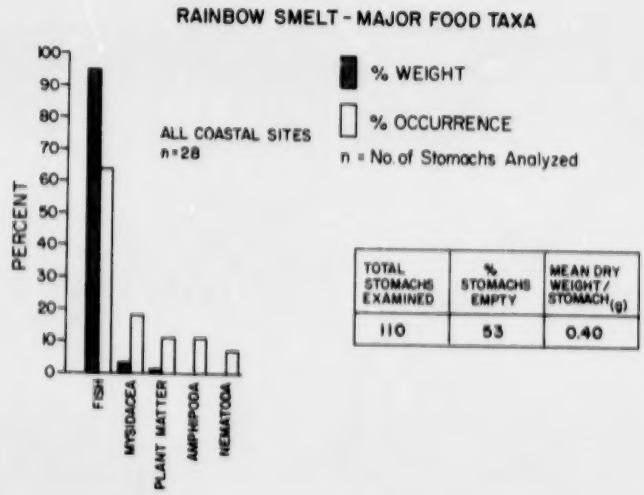


Fig. 69. Diet of rainbow smelt captured between late June and mid-September 1978-1980, as revealed by analysis of stomachs from coastal areas of the southeastern Beaufort Sea.

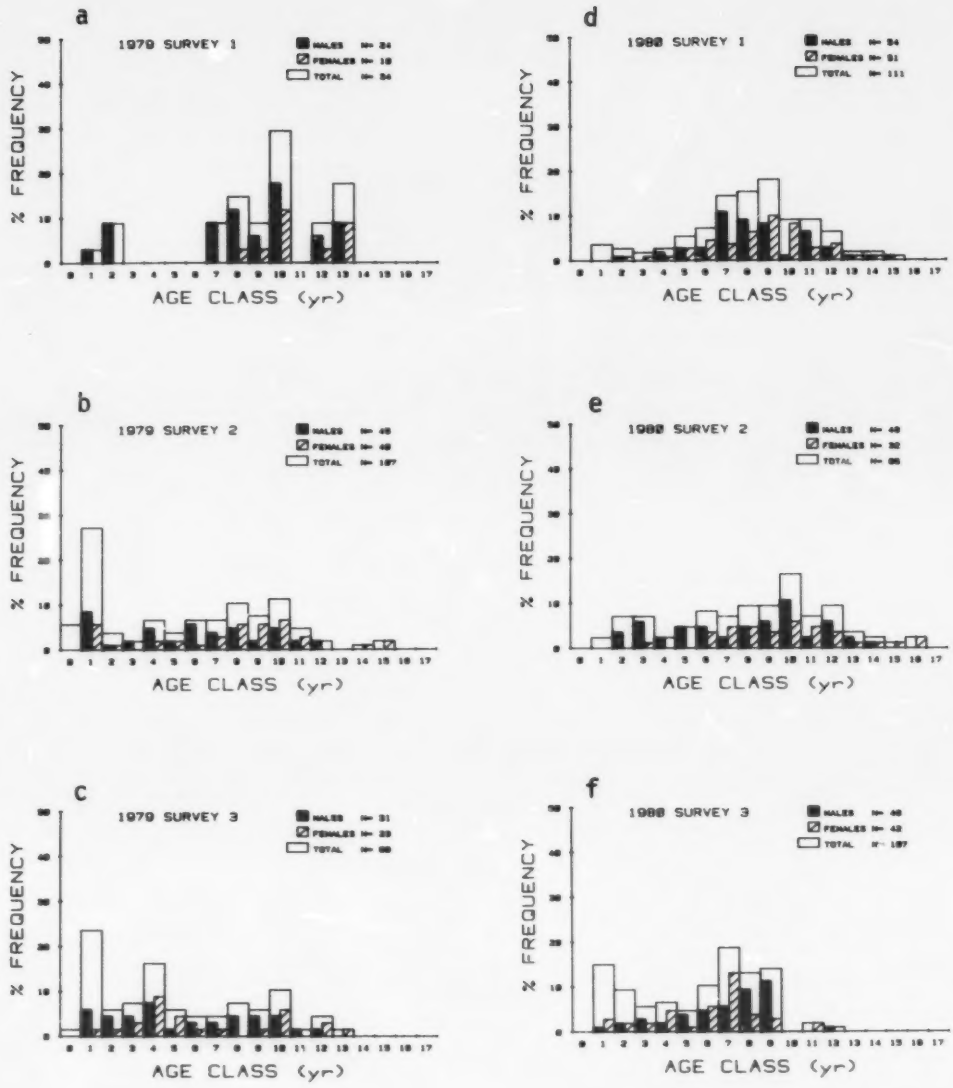


Fig. 70. Age-frequency distribution of gillnetted broad whitefish from freshwater lakes of Richards Island and Tuktoyaktuk Peninsula: a), b), c) 1979 surveys 1 (June/July), 2 (August) and 3 (September) respectively; d), e), f) 1980 surveys 1 (June/July), 2 (August) and 3 (September) respectively.

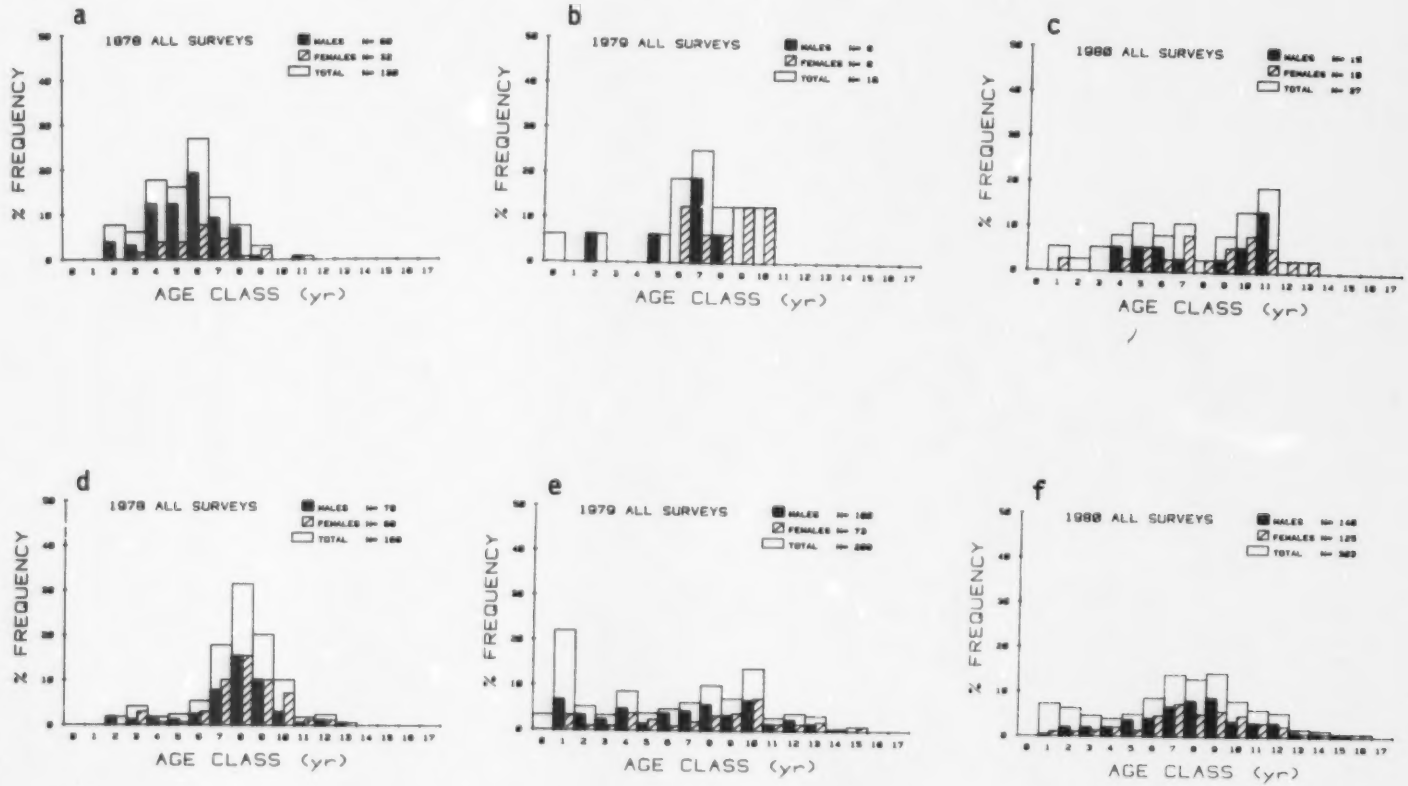


Fig. 71. Age-frequency distribution of gillnetted broad whitefish from coastal embayments and freshwater lakes of Richards Island and Tuktoyaktuk Peninsula: a), b), c) combined coastal surveys data, freshwater lakes for 1978, 1979 and 1980 respectively; d), e), f) combined lake surveys data, 1978, 1979 and 1980 respectively.

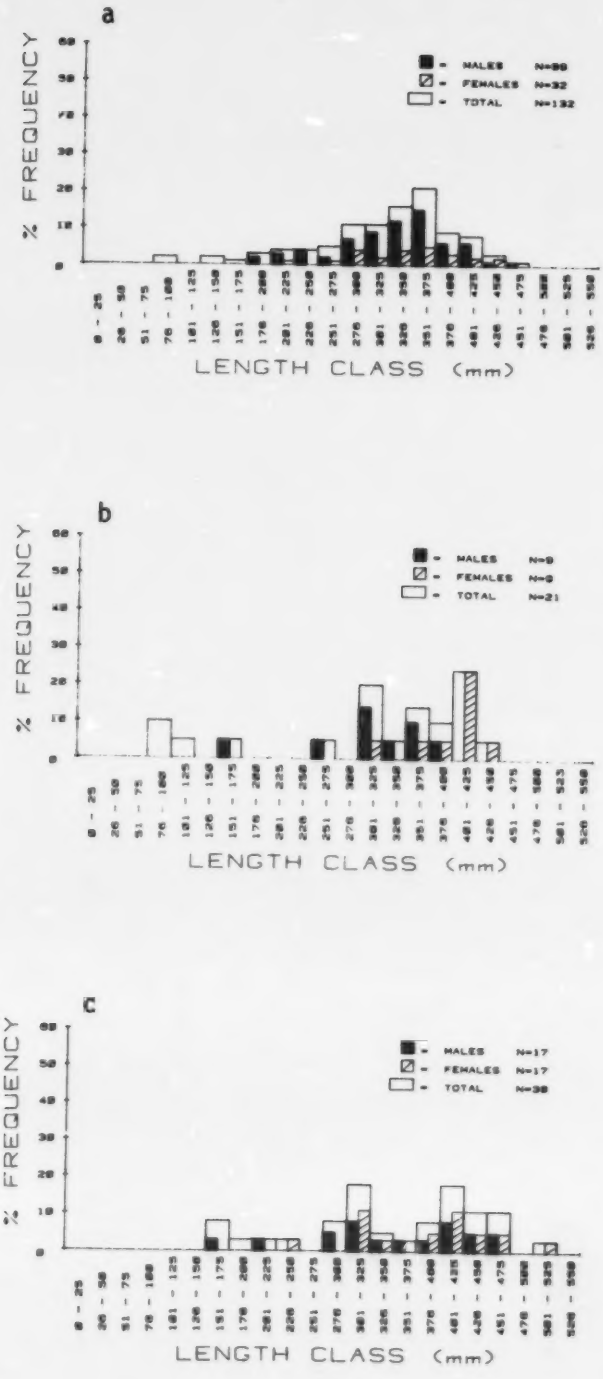


Fig. 72. Length-frequency distribution of gillnetted broad whitefish from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) combined surveys data for 1978, 1979 and 1980 respectively.

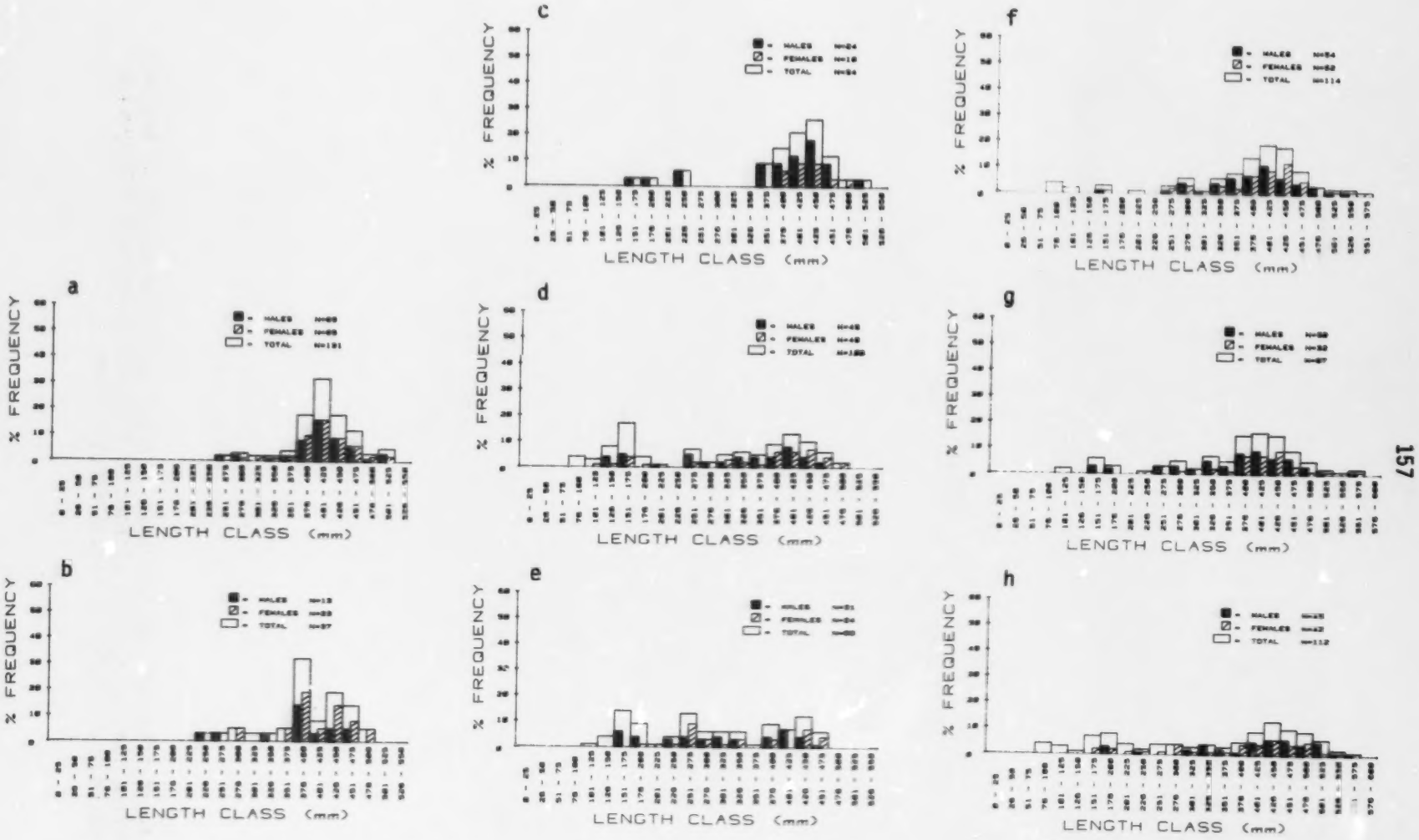


Fig. 73. Length-frequency distribution of gillnetted broad whitefish from freshwater lakes of Richards Island and Tuktoyaktuk Peninsula: a), b), 1978 surveys 2 (August) and 3 (September) respectively; c), d), e) 1979 surveys 1 (June/July), 2 (August) and 3 (September) respectively; f), g), h) 1980 surveys 1 (June/July), 2 (August) and 3 (September) respectively.

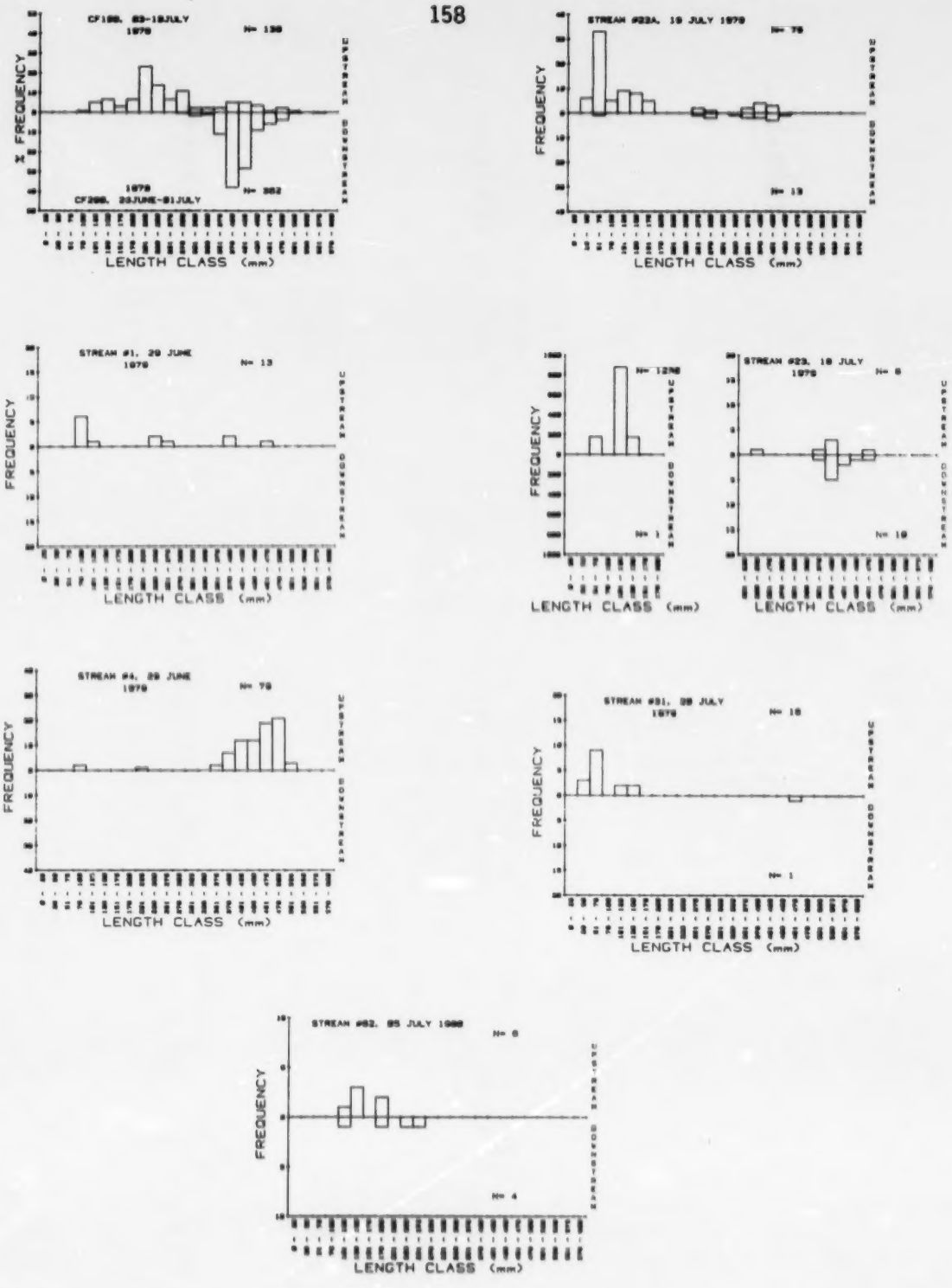


Fig. 74. Length-frequency distribution of broad whitefish caught in hoopnets during the spring from streams of Richards Island and Tuktoyaktuk Peninsula. (Refer to Fig. 1 for locations.)

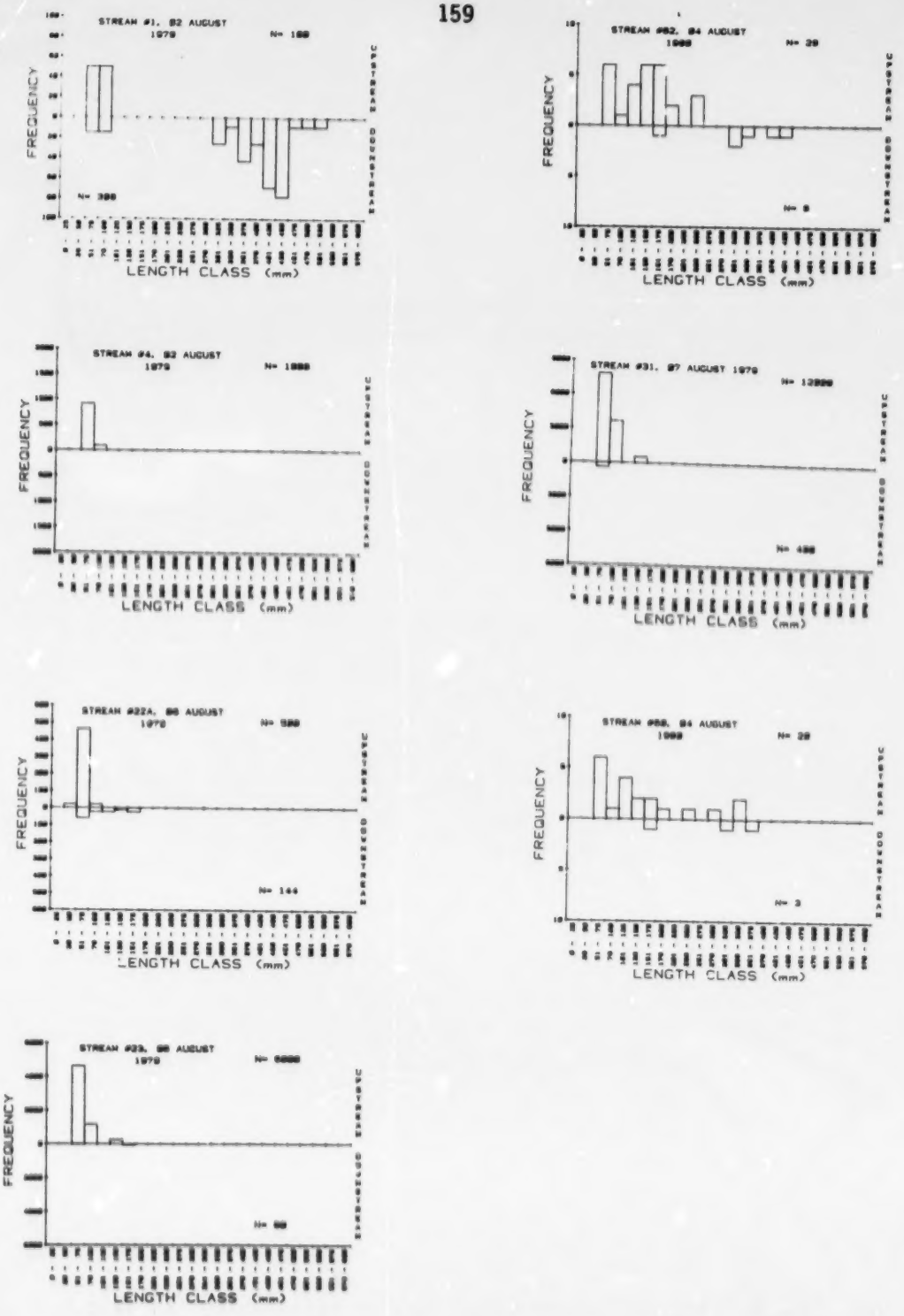


Fig. 75. Length-frequency distribution data of broad whitefish caught in hoopnets during the summer from streams of Richards Island and Tuktoyaktuk Peninsula. (Refer to Fig. 1 for locations.)

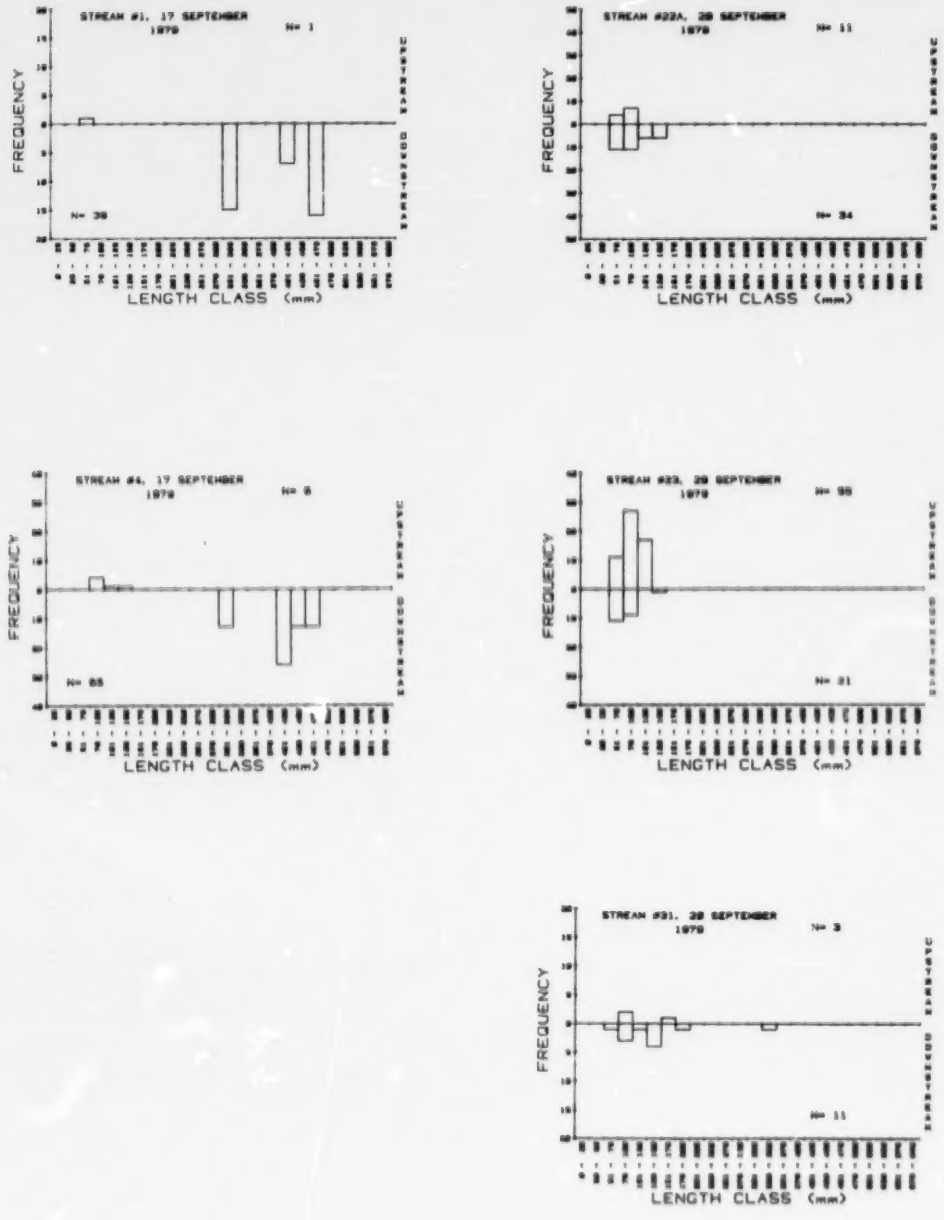


Fig. 76. Length-frequency distribution data of broad whitefish caught in hoopnets during the fall from streams of Tuktoyaktuk Peninsula. (Refer to Fig. 1 for locations.)

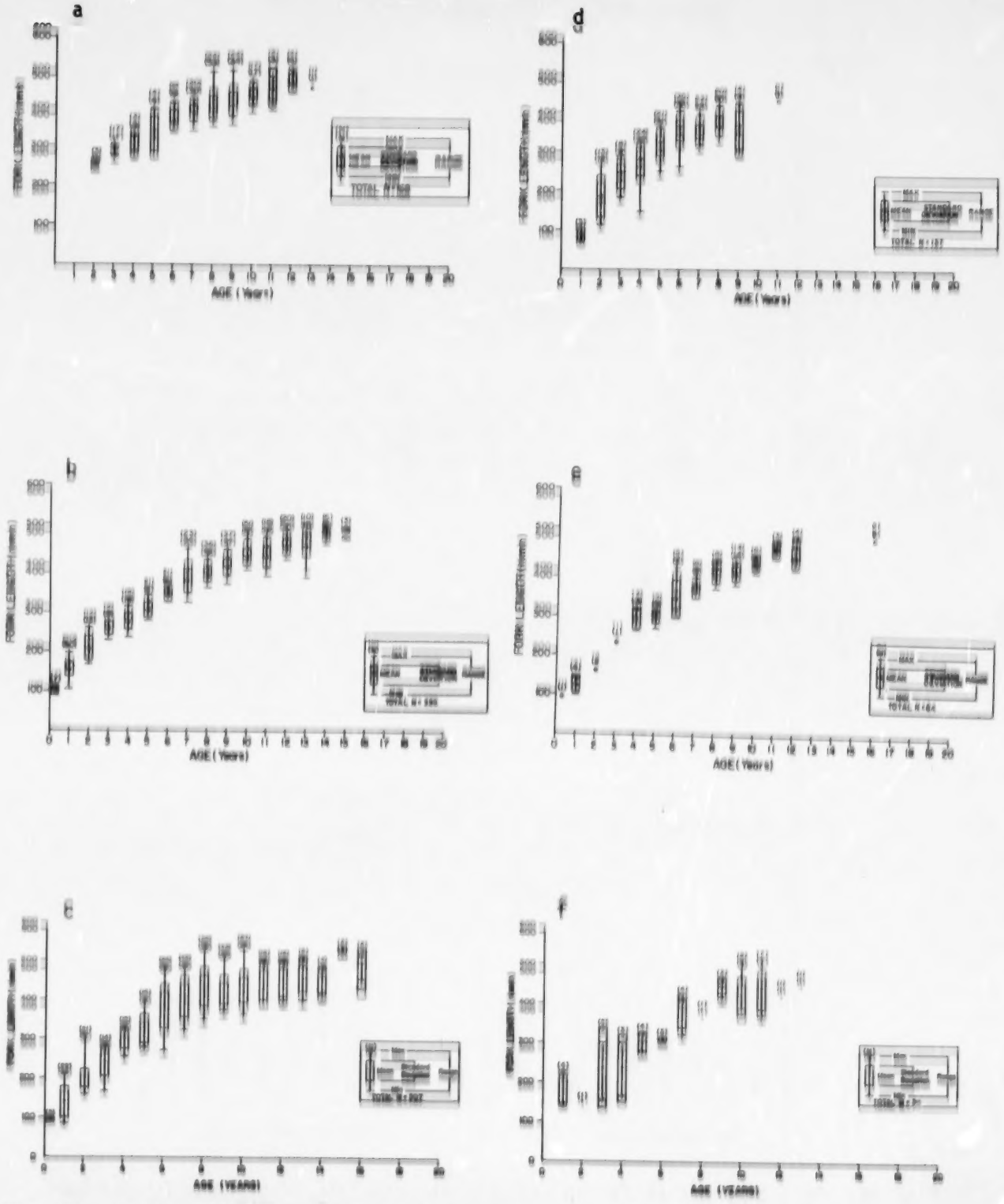
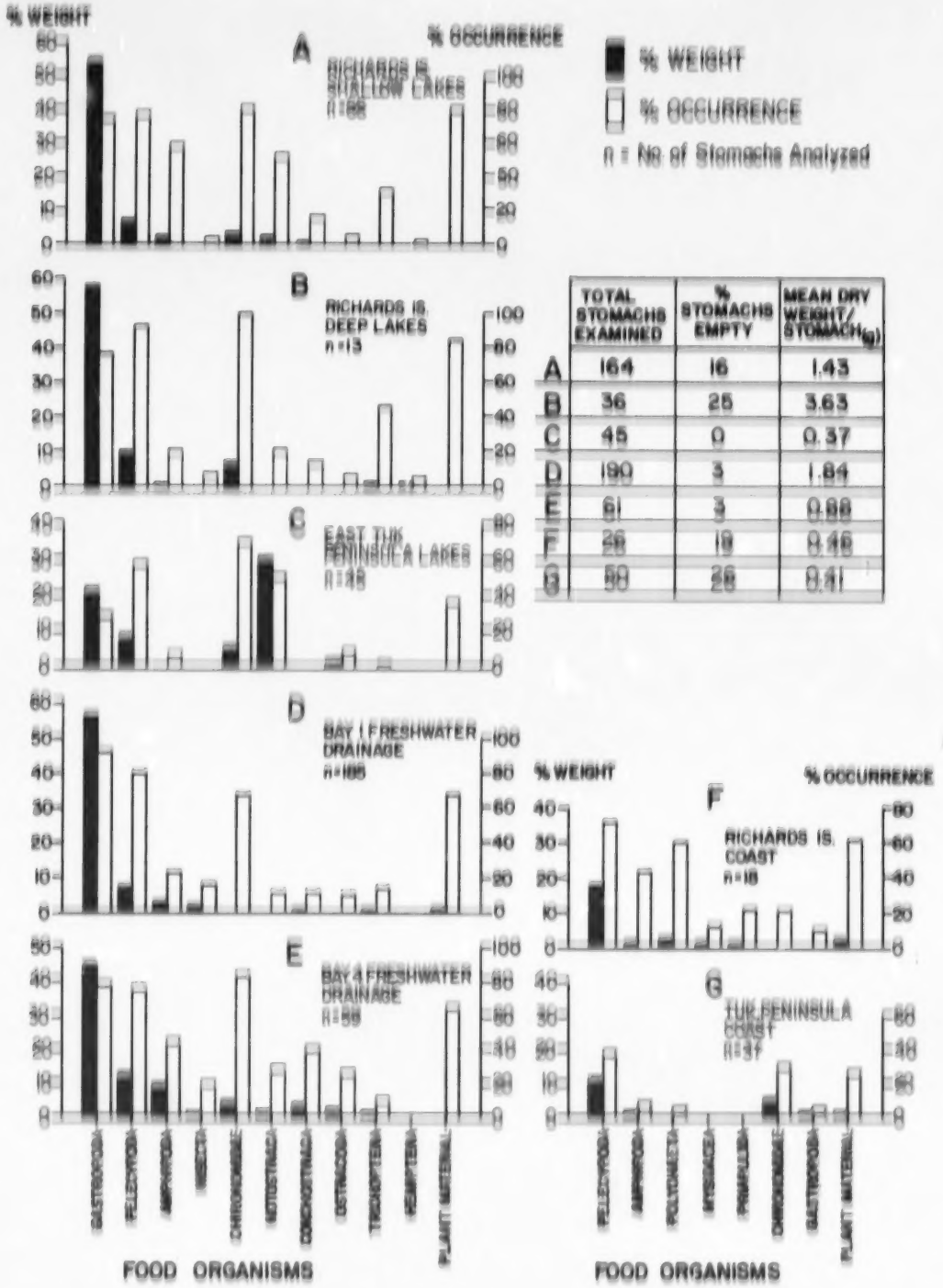


Fig. 77. Broad whitefish age-length relationships: a), b), c) combined freshwater lake surveys data 1978, 1979 and 1980 respectively; d), e), f) combined coastal surveys data, 1978, 1979 and 1980 respectively.

BROAD WHITEFISH - MAJOR FOOD TAXA



	TOTAL STOMACHS EXAMINED	% STOMACHS EMPTY	MEAN DRY WEIGHT/ STOMACH (g)
A	164	16	1.43
B	36	25	3.63
C	45	9	0.37
D	190	3	1.84
E	61	3	0.88
F	26	19	0.46
G	50	26	0.41

Fig. 78. Diet of broad whitefish captured between late June and mid-September 1978-1980, as revealed by analysis of stomachs from freshwater lakes on Richards Island and Tuktoyaktuk Peninsula and coastal areas of the southeastern Beaufort Sea.

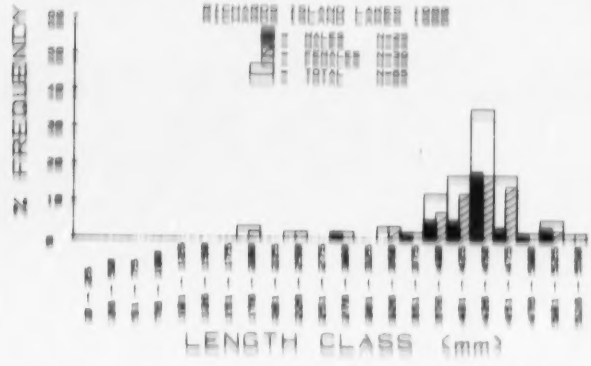


Fig. 79. Length-frequency distribution of gillnetted lake whitefish from freshwater lakes of Richards Island - combined surveys data 1980.

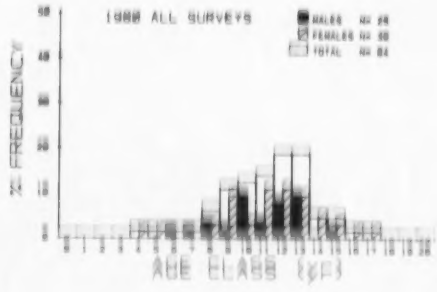


Fig. 80. Age-frequency distribution of gillnetted lake whitefish from freshwater lakes of Richards Island - combined surveys data 1980.

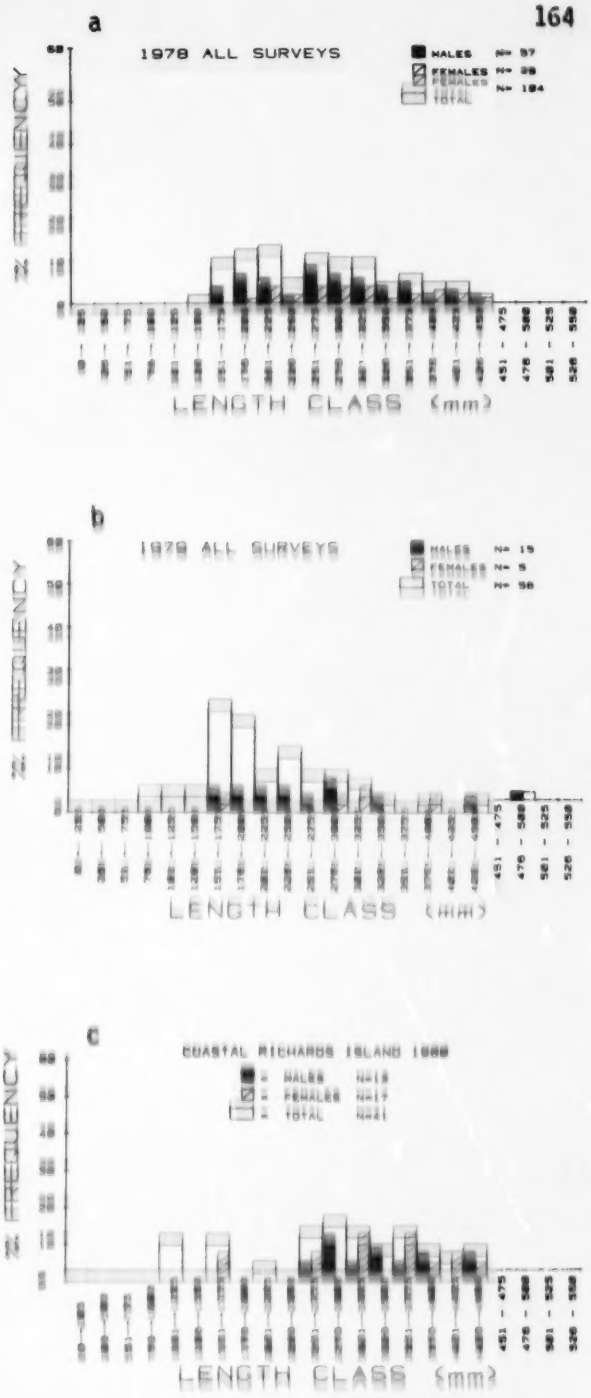


Fig. 81. Length-frequency distribution of gillnetted lake whitefish from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) combined surveys data 1978, 1979 and 1980 respectively.

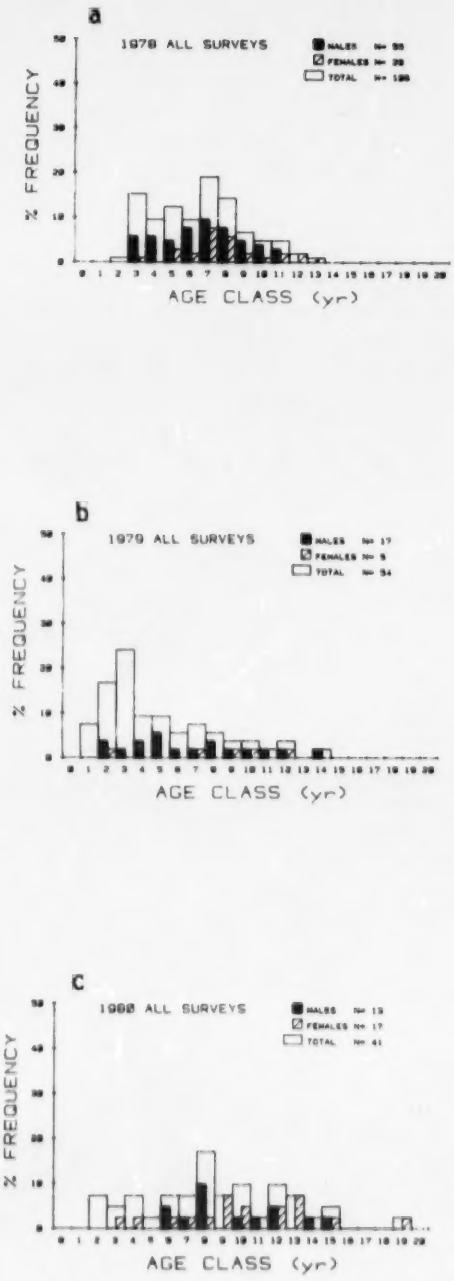


Fig. 82. Age-frequency distribution of gillnetted lake whitefish from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b), c) combined surveys data 1978, 1979 and 1980 respectively.

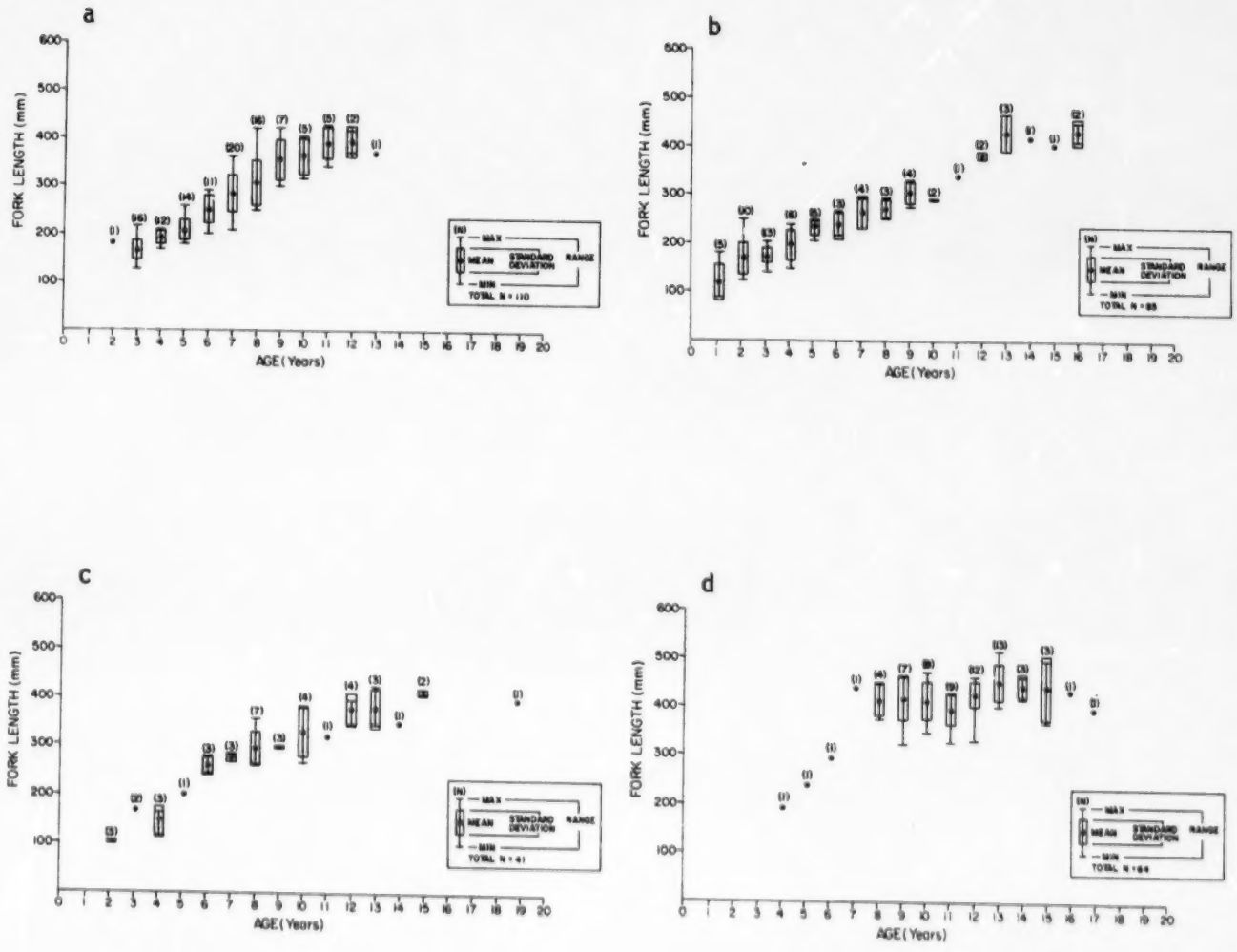
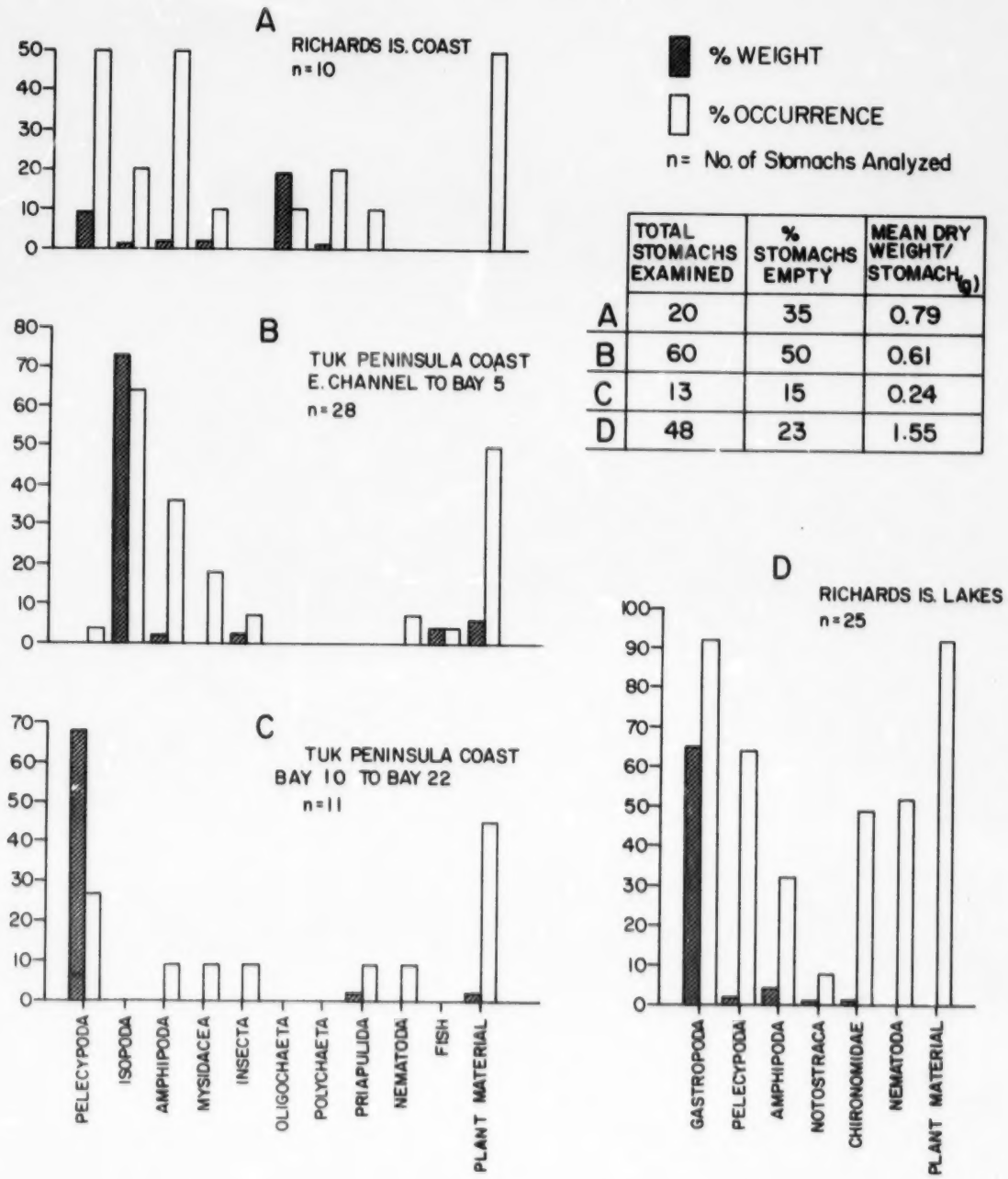


Fig. 83. Lake whitefish age-length relationships: a), b), c) combined coastal surveys data 1978, 1979 and 1980 respectively; d) combined freshwater lake surveys data 1980.

LAKE WHITEFISH - MAJOR FOOD TAXA



	TOTAL STOMACHS EXAMINED	% STOMACHS EMPTY	MEAN DRY WEIGHT/ STOMACH (g)
A	20	35	0.79
B	60	50	0.61
C	13	15	0.24
D	48	23	1.55

Fig. 84. Diet of lake whitefish captured between late June and mid-September 1978-1980, as revealed by analysis of stomachs from freshwater lakes and coastal areas of the southeastern Beaufort Sea.

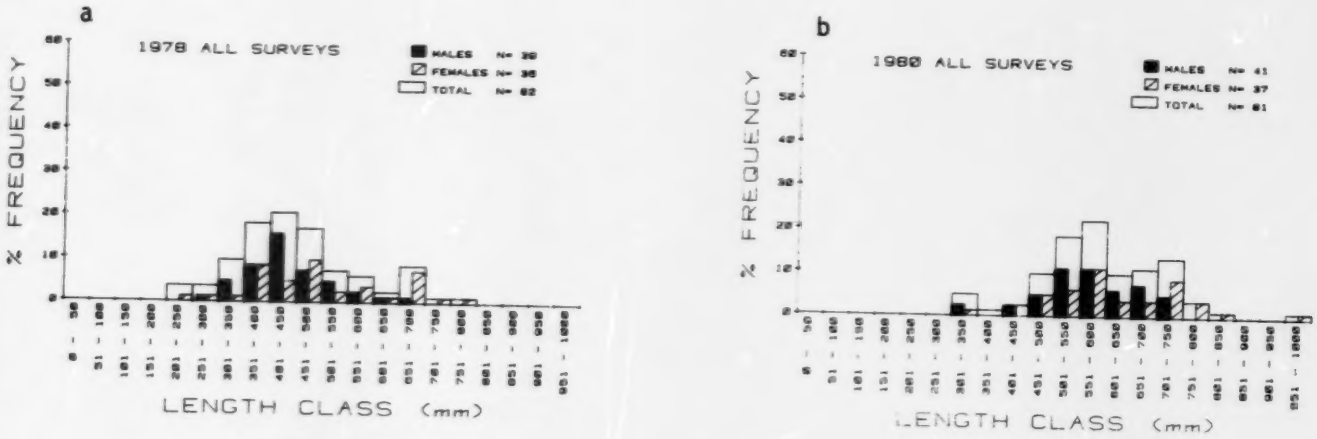


Fig. 85. Length-frequency distribution of gillnetted inconnu from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b) combined surveys data 1978 and 1980 respectively.

Fig. 86. Age-frequency distribution of gillnetted inconnu from coastal embayments of Richards Island and Tuktoyaktuk Peninsula: a), b) combined surveys data 1978 and 1980 respectively.

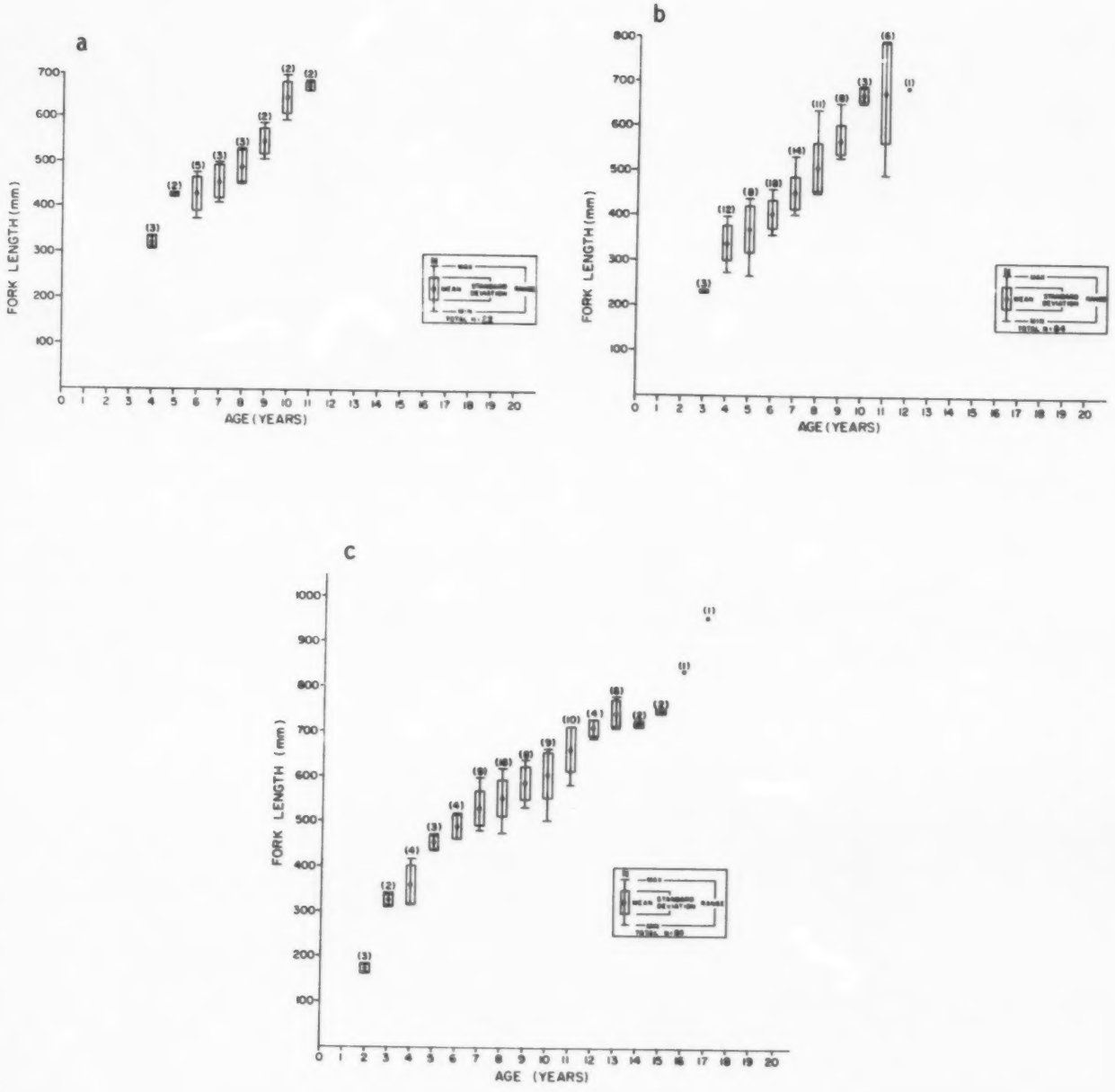
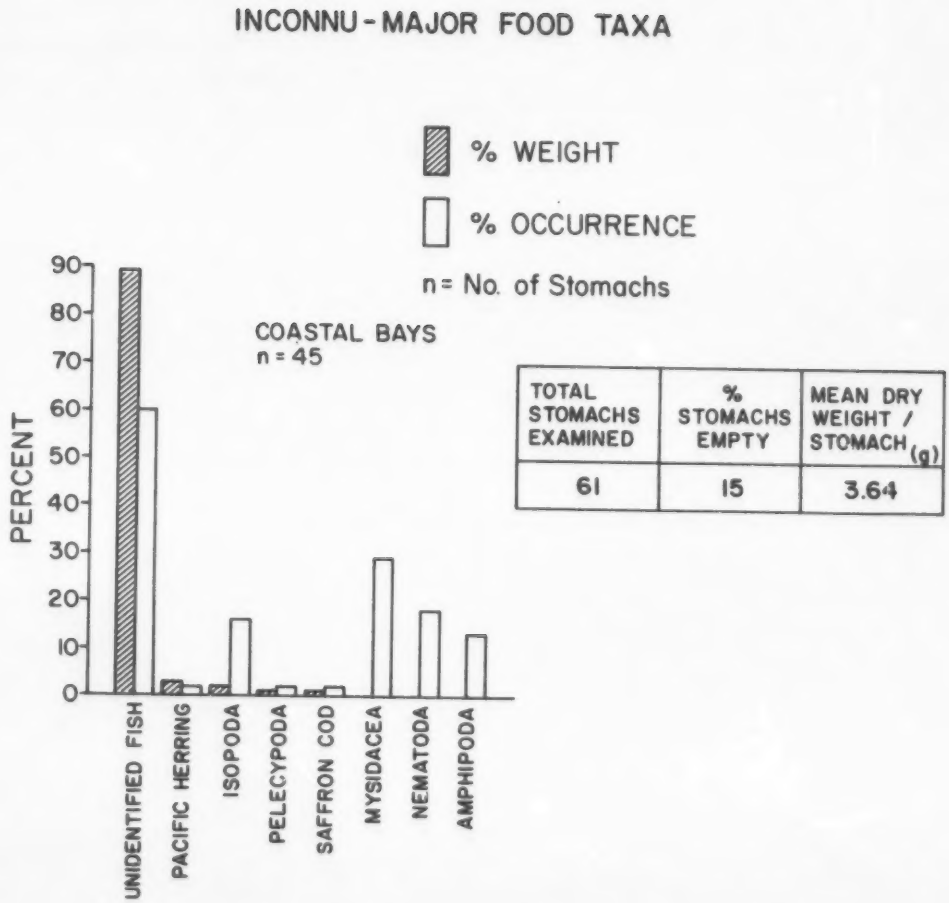


Fig. 87. Inconnu age-length relationships: a), b), c) combined surveys data for 1978, 1979 and 1980 respectively.



TOTAL STOMACHS EXAMINED	% STOMACHS EMPTY	MEAN DRY WEIGHT / STOMACH (g)
61	15	3.64

Fig. 88. Diet of inconnu captured between late June and mid-September 1978-1980, as revealed by analysis of stomachs from coastal areas of the southeastern Beaufort Sea.

Fig. 89. Distribution of lake trout within the study area.

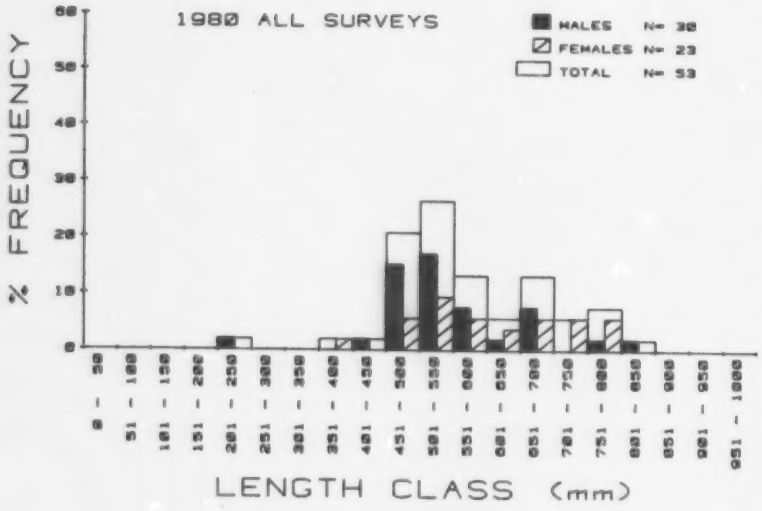


Fig. 90. Length-frequency distribution of lake trout from freshwater lakes of Richards Island; combined surveys data 1980.

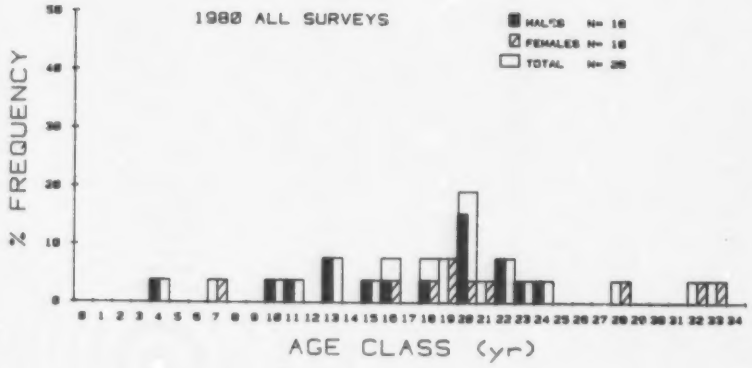


Fig. 91. Age-frequency distribution of lake trout from freshwater lakes of Richards Island; combined surveys data 1980.

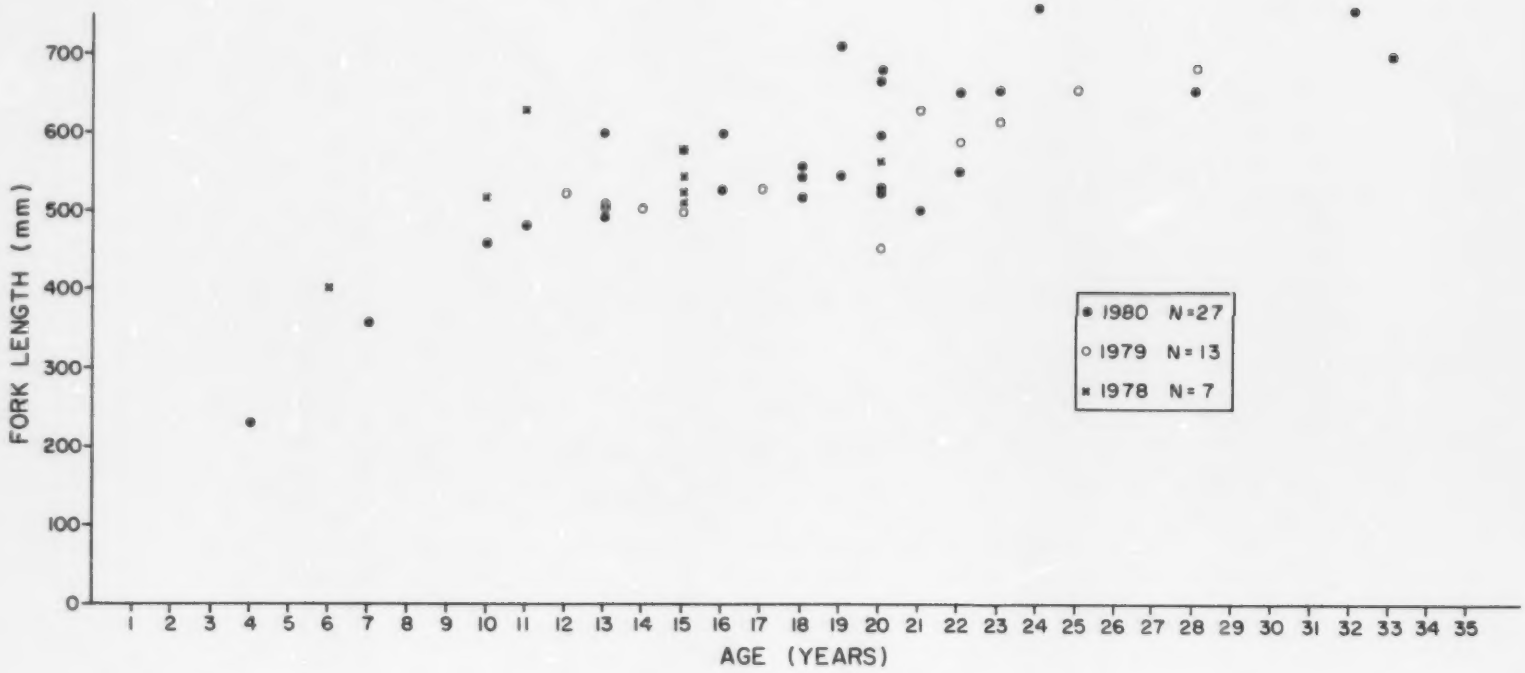


Fig. 92. Lake trout age-length relationships; data from 1978, 1979 and 1980.

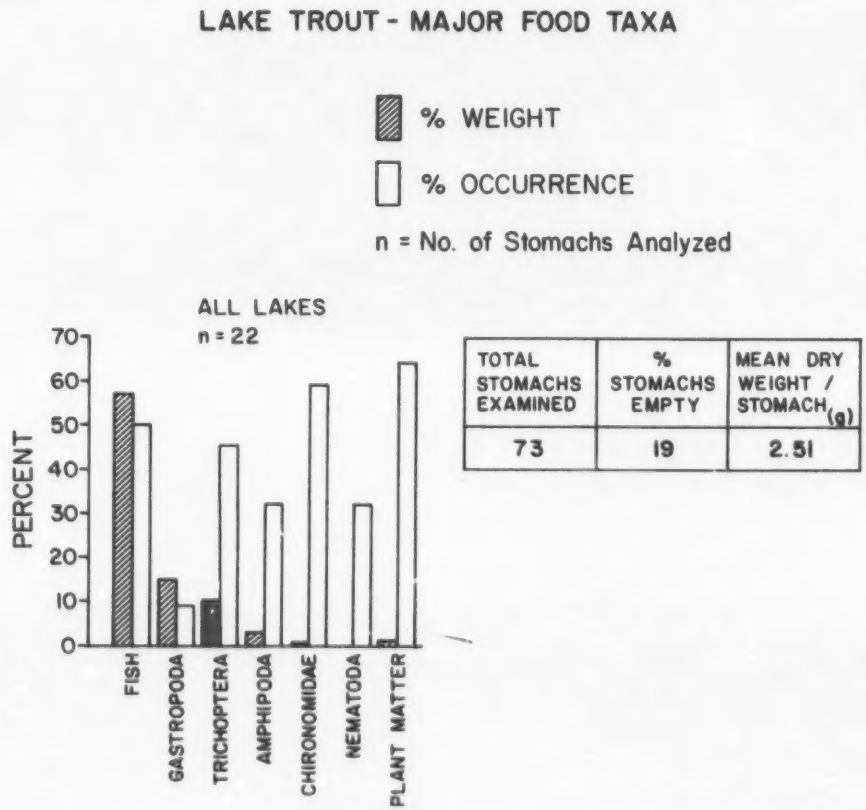


Fig. 93. Diet of lake trout captured between late June and mid-September 1979 and 1980, as revealed by analysis of stomachs from freshwater lakes of Richards Island and Tuktoyaktuk Peninsula.

Fig. 94. Distribution of northern pike within the study area.

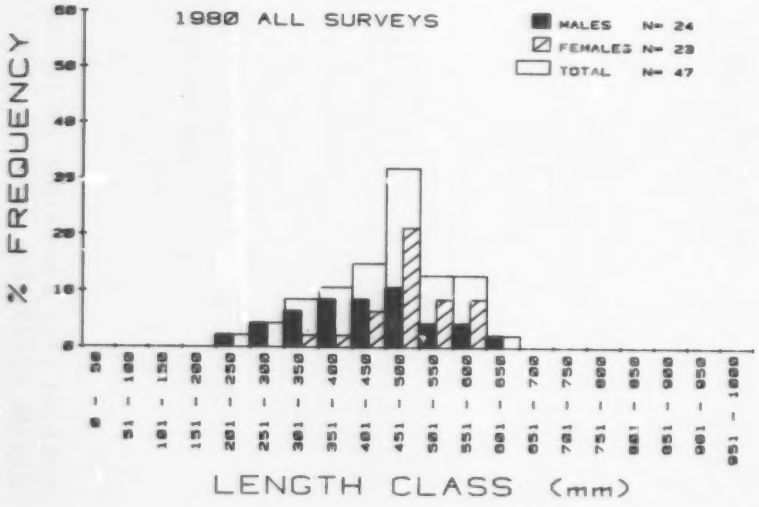


Fig. 95. Length-frequency distribution of northern pike from freshwater lakes of Richards Island and Tuktoyaktuk Peninsula; combined surveys data 1980.

Fig. 96. Age-frequency distribution of northern pike from freshwater lakes and streams of Richards Island and Tuktoyaktuk Peninsula; combined surveys data 1980.

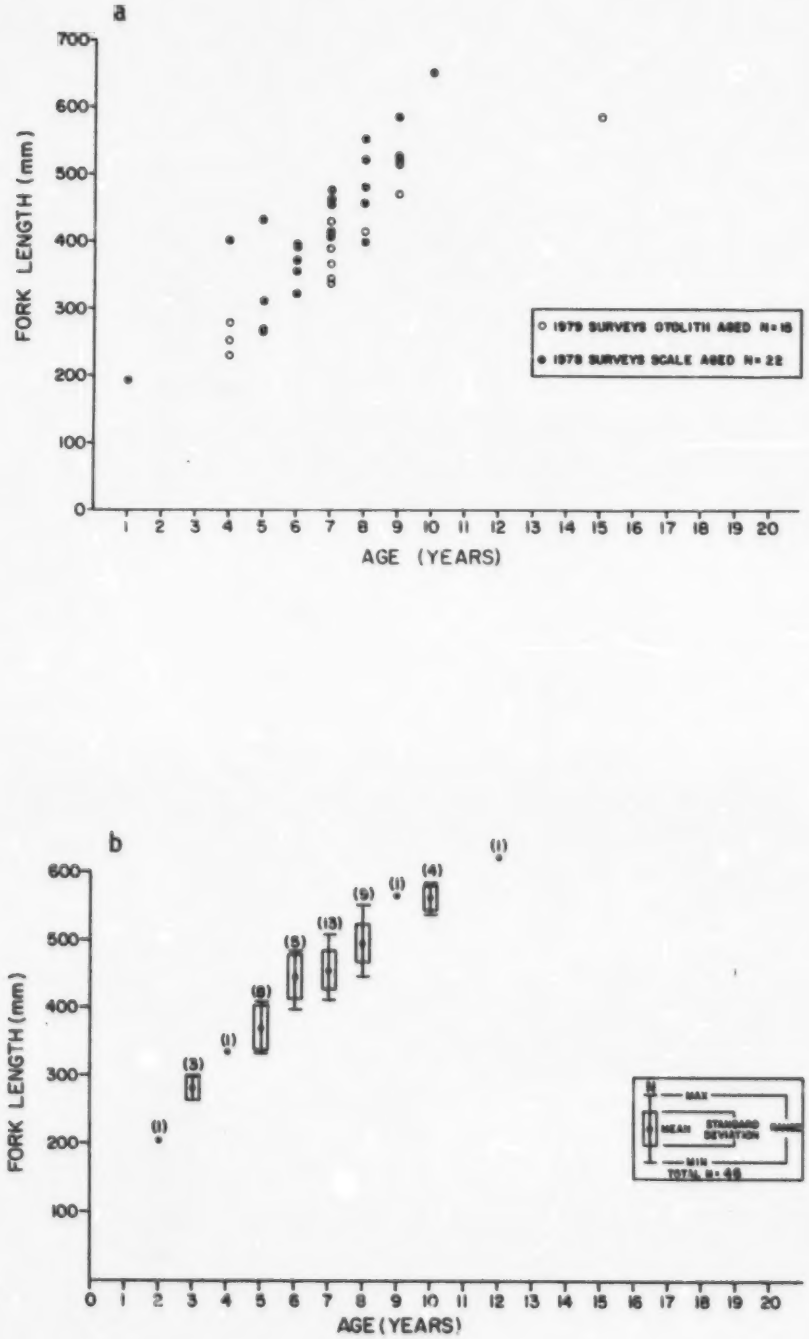


Fig. 97. Northern pike age-length relationship: a) combined scale (1978) and otolith (1979) age data; b) combined surveys data 1980.

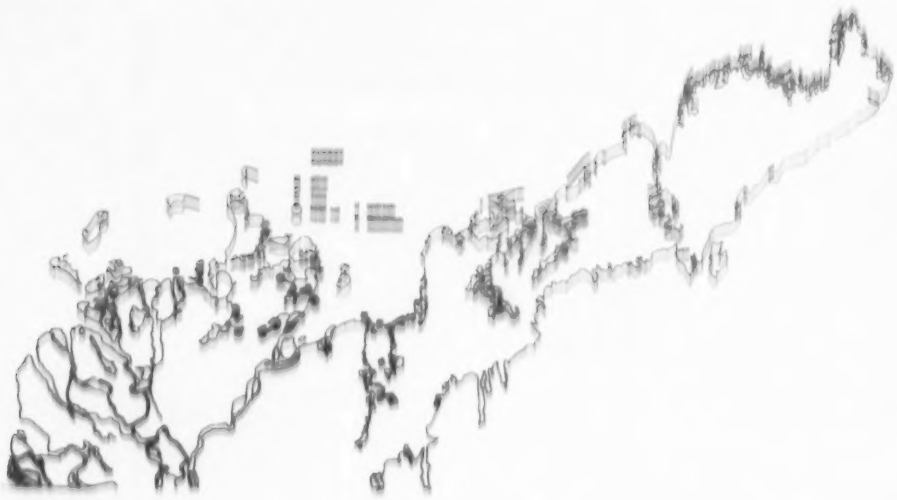


Fig. 98. Distribution of burbot within the study area.

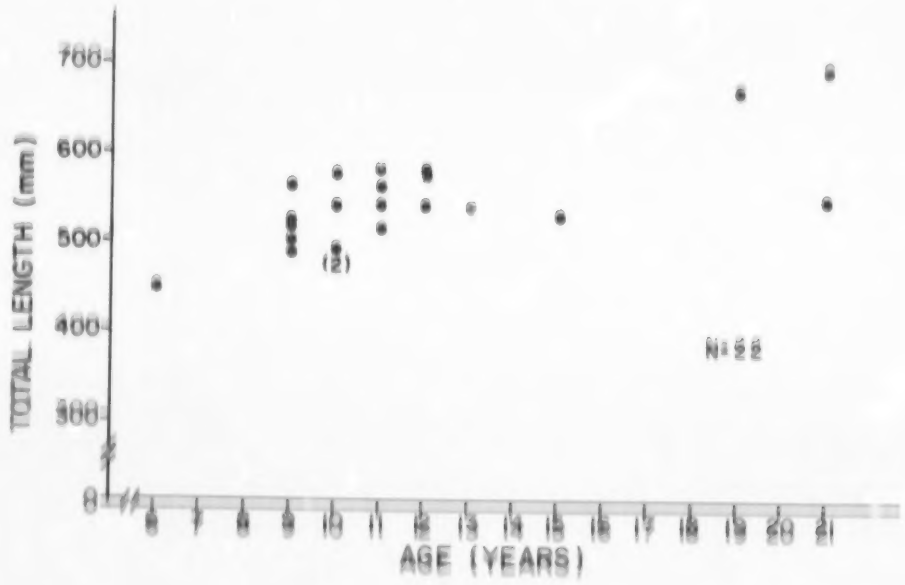


Fig. 99. Burbot age-length relationship; combined surveys 1980.

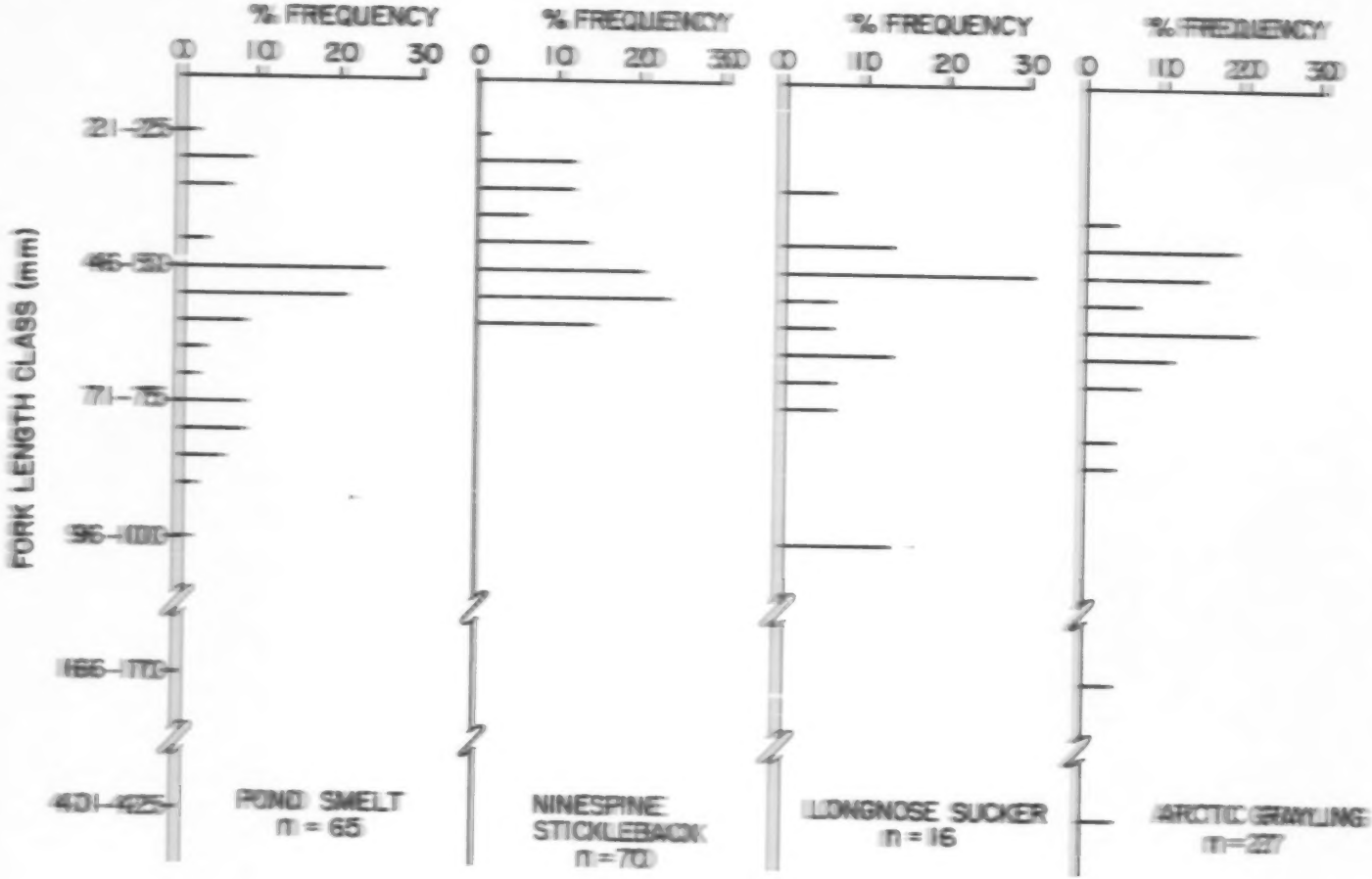


Fig. 100. Length-frequency distribution of pond smelt, ninespine stickleback, longnose sucker and Arctic grayling from freshwater and coastal areas off Richard Island and Tuktoyaktuk Peninsula.

Fig. 101. Distribution of ninespine stickleback within the study area.

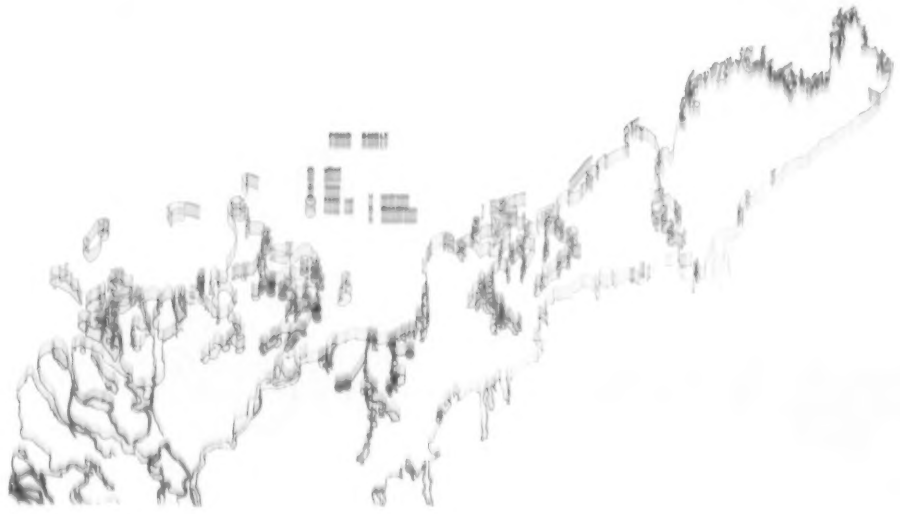


Fig. 102. Distribution of pond smelt within the study area.

Fig. 103. Distribution of longnose sucker within the study area.

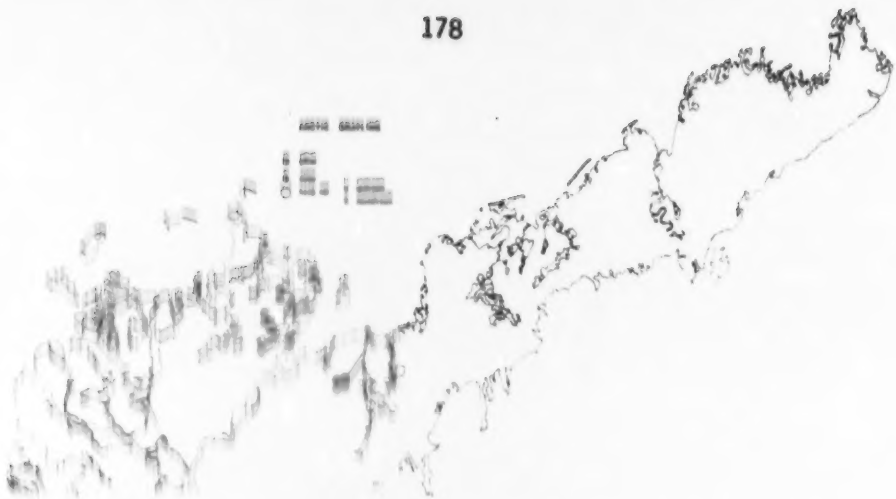


Fig. 104. Distribution of Arctic grayling within the study area.

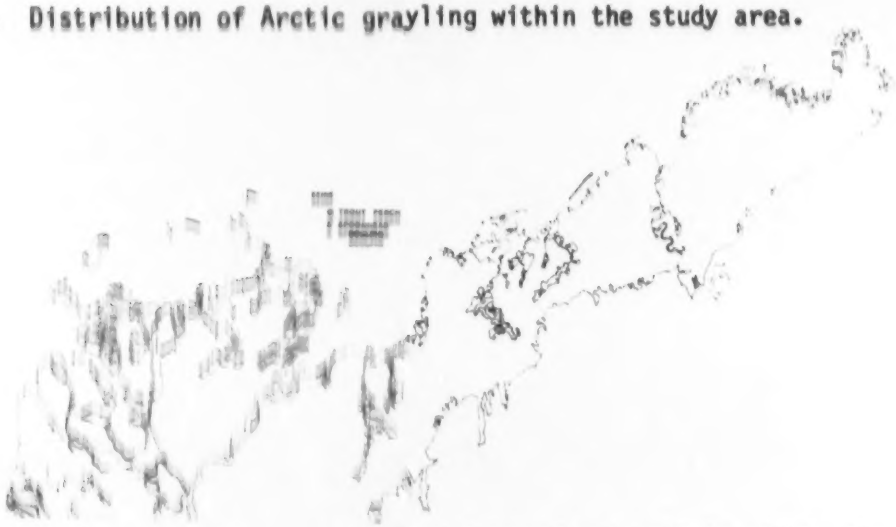


Fig. 105. Distribution of trout-perch and spoonhead sculpin within the study area.

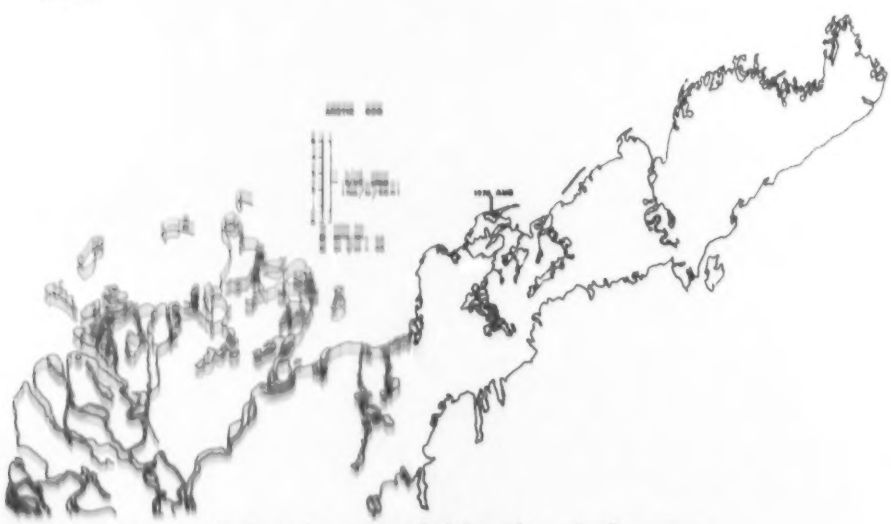


Fig. 106. Distribution of Arctic cod within the study area.